299

GAS JOURNAL

LIGHT . HEAT . POWER . BYE-PRODUCTS

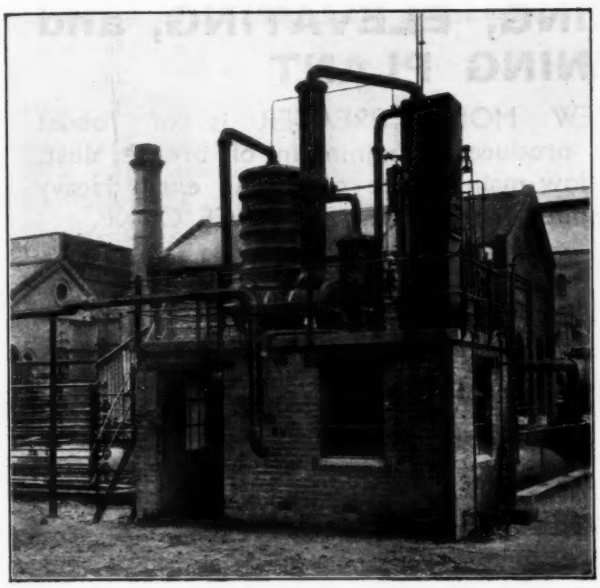
[Founded in 1849 as the "Journal of Gas Lighting."]

Vol. 202. 85th Year. LONDON, MAY 10, 1933. No. 3651. Price 1s.

50,000 Gallons of BENZOLE

produced daily by

SIMON-CARVES BENZOLE PLANTS



Simon-Carves Benzole Plant at North Shields for the Newcastle-upon-Tyne and Gateshead Gas Co., recovering 275 gallons per day of 90% Benzole at 120° C.

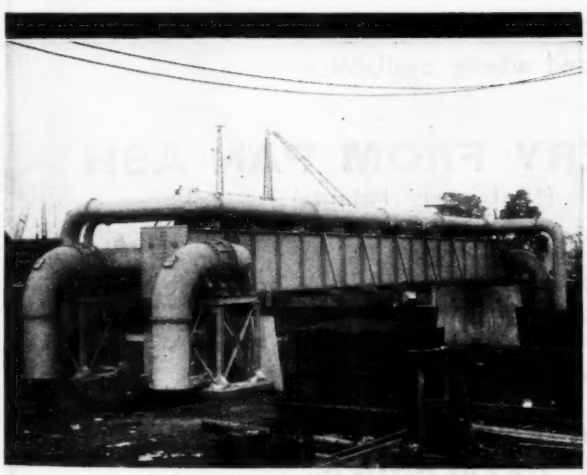
Main steam and water feeds on Simon-Carves Benzole plants are thermostatically controlled, thus only occasional attendance is required on the plant.

Over 30 years' experience in the construction and operation of benzole plants ensures dependable and satisfactory operation.

Write to us for full particulars. Our expert advice is at your service.

SIMON-CARVES LTD

CHEADLE HEATH, STOCKPORT



Pipes and Pipe Bridges of special design

The illustration shows a Steel Box Girder Gas Main supplied to the City of Leicester Gas Department. It is 88 ft. 9 ins. long by 5 ft. 7 ins. wide by 6 ft. 1 in. deep with 3 ft. diameter connections.

We specialize in the manufacture of Steel Mains of 14 in. diameter upwards, and have successfully completed many important contracts in all parts of the Country.

We shall be pleased to send you further particulars.

THE HORSELEY BRIDGE AND ENGINEERING CO., LTD.
incorporating
THOMAS PIGGOTT & CO., LTD.
HORSELEY HOUSE, 85, LIONEL STREET, BIRMINGHAM.
LONDON OFFICE: 22, CARLISLE PLACE (VICTORIA STREET), S.W 1.
WORKS: BIRMINGHAM, TIPTON AND CARDIFF.

INSULATING BRICKS — RECUPERATOR TUBES

Special semi-silica quality for Segmental Retorts with no Expansion or Contraction at 1400° C.

HARRIS & PEARSON, LTD., STOURBRIDGE, ENGLAND

COKE

We specialise in

COKE — BREAKING, ELEVATING, and SCREENING PLANT

Waller's NEW MODEL BREAKER is of robust construction, produces a minimum of breeze dust, and ensures low maintenance cost. An extra Heavy Model is supplied for breaking FURNACE COKE.

Portable Breaking and Screening Plants.

Small Plants for small works.

COKE — WASHING PLANT

("Retriever" Patents)

Producing clean washed Nuts.

Simple—efficient—very little water required.

In conjunction with the above,

COKE — DRYING PLANT

for abstracting the moisture from Washed Coke, and eliminating all dust.

Waste Heat used where available.

COKE — RECOVERY FROM PAN ASH

("Retriever" Patents)

A paying proposition.

Recovering from 35 °/₀ to 45 °/₀ good clean Fuel from Waste Material.

SEND US YOUR ENQUIRIES
WRITE FOR OUR CATALOGUES

GEO. WALLER & SON, Ltd. PHŒNIX IRON WORKS, STROUD, GLOS.

Telegrams: "WALLER, BRIMSCOMBE." Telephone: 10 BRIMSCOMBE.

LONDON OFFICE: 149-150, PALACE CHAMBERS, S.W. 1. Telephone: WHITEHALL 5526.

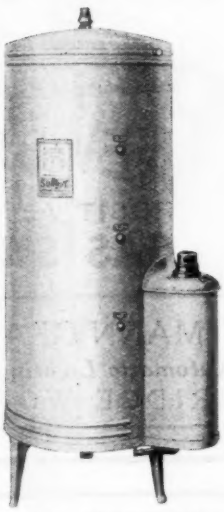
AGENTS FOR SCOTLAND · MESSRS. MILNE & MITCHELL, 75, BATH STREET, GLASGOW, C. 2.

GAS WATER HEATERS

THE LATEST "SUNHOT."

A great development in the "SUNHOT" Water Heater is the introduction of the "N.C." Series. "N.C." means NO CONDENSE—condensation within the heater being eliminated by the use of a heating unit of special construction.

The "SUNHOT"
(Standard & Copper Type)



The "SUNHOT"
(Calorifier Type)

The "SUNHOT"
(Ball-valve Type)

The "K.C.U."
CIRCULATOR

THE LATEST "SUNHOT" WATER HEATERS

are made in several sizes, there being a heater for every purpose and condition of water supply.

STANDARD TYPE for moderately "hard" water—with galvanized sheet steel storage and porcelain enamelled cast iron heating unit.

COPPER TYPE for "soft" water—with copper storage and copper heating unit.

CALORIFIER TYPE for very "hard" water—the contents of the storage is heated by water circulating in a closed system, preventing the heavy deposit of mineral residue.

BALL-VALVE TYPE for direct connection to Water Mains—specially designed for premises where a cold water feed cistern is not available. Offered in Standard or Copper type for varying water conditions.

A NEW CIRCULATOR.

The "K.C.U." Circulator is an entirely new water heater, designed on the "N.C." principle for use with existing household hot water tanks or cylinders, either to supplement the supply of hot water from the back range boiler or for use as an independent unit. It is made in two sizes, consuming 10 and 25 cubic feet per hour respectively. The "K.C.U." Circulator is made in Porcelain Enamelled Iron and also in Copper, to suit "hard" or "soft" water.

The "K.C.U." Circulator will quickly become as popular as the well known "K.C.U." Sink Heater.

ARDEN HILL & CO., LTD.,

ACME WORKS, ASTON, BIRMINGHAM 6.

(Radiation Ltd., Proprietors).

NEWBRIDGE
GAS CONTROLLERS

Careful thought and experience in design, the best of British workmanship and materials, allied to the most up-to-date production and inspection methods, result in the utmost efficiency from Newbridge Controllers.

Install them and improve your street lighting.

Let us submit Samples now for test under actual working conditions, together with quotation and catalogue.

Type 3A/UNI-15 day run
For "square" lanterns

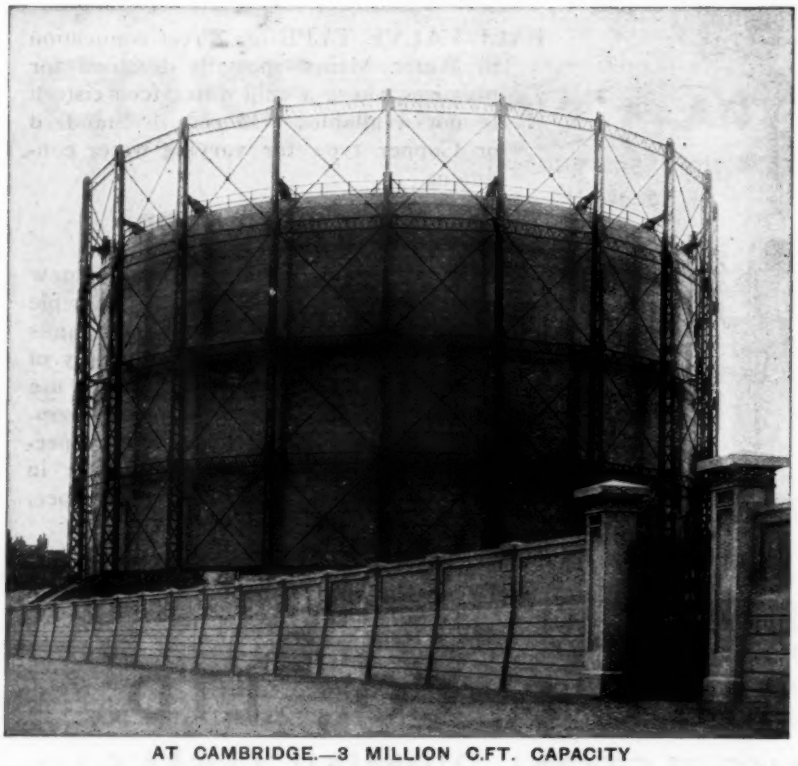
They SELL because they EXCEL.

Newbridge Gas Switches make gas as convenient as electricity for indoor lighting, with the advantage that the *lights may be dimmed.* They are fully guaranteed and will help you to retain your domestic lighting load. Flush hand controls and Duplex sets for two-way switching are available at a slight extra cost.

Stock, recommend and SELL this modern development of gas lighting. Catalogue post free on request.

NEWBRIDGE
POSITIVE DISTANCE GAS SWITCHES

The HORSTMANN GEAR COMPANY Ltd.
Automatic Lighting Engineers
NEWBRIDGE WORKS - BATH



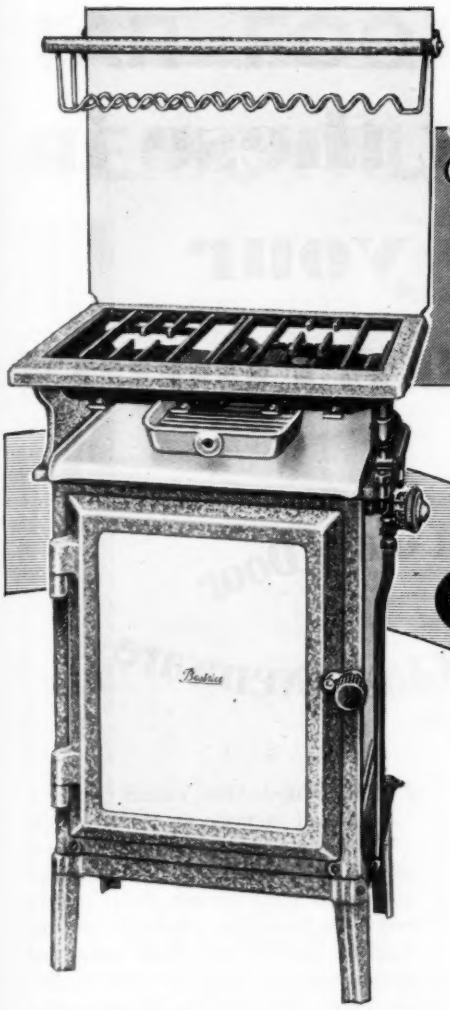
AT CAMBRIDGE.—3 MILLION C.FT. CAPACITY

GAS HOLDERS

GUIDE FRAMED
AND
SPIRAL GUIDED
WITH OR WITHOUT
STEEL TANKS
WATERLESS (KLÖNNE) GASHOLDERS
HIGH PRESSURE GASHOLDERS

C. & W. WALKER, LTD.
DONNINGTON, NR. WELLINGTON—SHROPS.

LONDON OFFICE: 70, VICTORIA STREET, WESTMINSTER, S.W. 1.



The New "BEATRICE" GAS COOKER Model No 33.

8 OUTSTANDING NEW FEATURES

ONE BURNER OVEN AND BOTTOM FLUE OUTLET.

ONE PIECE ALL STEEL GATES AND OVEN SHELVES.

MAXIMUM COOKING SPACE IN OVEN, WITH *NO PROJECTIONS AND CONSEQUENT EASE IN CLEANING.*

HOT PLATE BURNERS SPACED TO GIVE FULLEST EFFICIENCY.

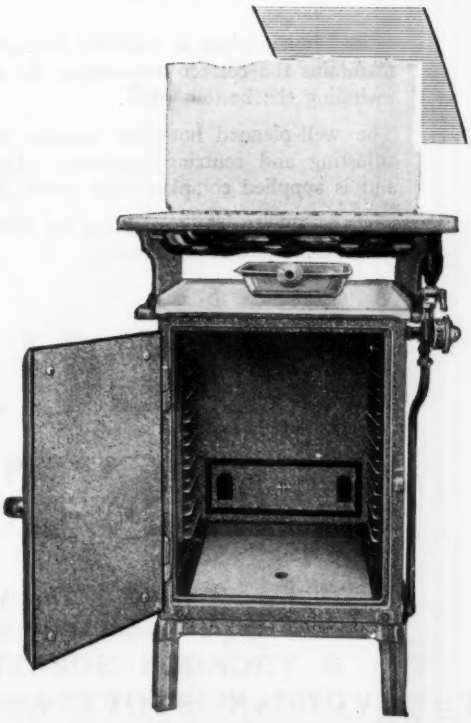
HOT PLATE BARS IN TWO SECTIONS ONLY AND CANNOT BE WRONGLY REPLACED.

OVEN AND DOOR LINED WITH CELLULAR ASBESTOS.

GREY MOTTLE AND WHITE ENAMEL FINISH AS SHOWN.

SPRING LOADED CHROMIUM PLATED TAPS. SAFETY SELF-LOCKING OVEN TAP.

Besides the Standard Finish (Grey Mottle) "Beatrice" Gas Cookers can now be obtained in Green or Blue "Snowdrift" Mottle Enamel.



Sole selling agents in Great Britain and Ireland for Gas Fires, Radiators, and Cookers manufactured by John Harper & Co., Ltd.

ECONOMIC GAS BOILER Co., Ltd.

Junction Mills :: :. Burnley.

Telephone: 3305 Burnley. Telegrams: Bluboilers Burnley.

Manufacturers:

JOHN HARPER & CO., LTD.

ALBION WORKS, WILLENHALL, STAFFS.

Telephone: Willenhall 124 (4 lines). Telegrams: Harpers, Willenhall.

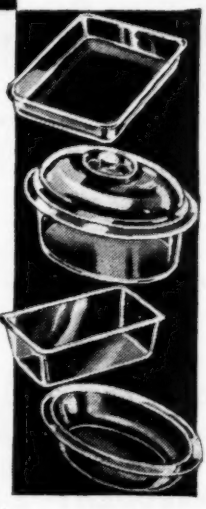
London Office: Atlantic House, 45/49, Holborn Viaduct, E.C.1

Telephone: Holborn 5154. Telegrams: Oilgas, Cent., London

Put these in your Showrooms

Fireproof Glass Door

Glass Ovenware



THIS up-to-date Vulcan Cooker is bound to make an instant appeal to your customers. The addition of an ARMOURPLATE GLASS door is a practical improvement, for it enables one to see the food in process of cooking, without opening the oven door and letting cold air rush in. The double glass door, heat-resisting and practically unbreakable, is constructed with an intervening air space, obviating condensation of moisture on the glass and maintaining an efficient insulation of the oven heat.

The "Equi-heat" oven, packed and enamel-lined, gives a uniform heat throughout, and the Vulcan Regulator (automatic oven-heat controller) maintains the correct temperature for all classes of cooking. The whole oven space is available for use, including the bottom plate.

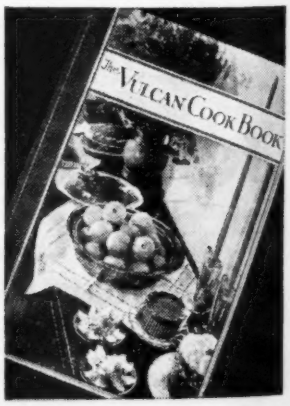
The well-planned hot-plate contains three boiling burners and reversible griller. All taps have patent self-adjusting and centring injectors. The stove is finished inside and outside in "Ceramic" porcelain enamel, and is supplied complete with stand, plate-rack, splasher-plate, and chromium-plated towel rail.

And, as appropriate equipment for this modern glass-panelled Cooker, a set of four pieces of Orlak Fireproof Glass Ovenware is included.

VULCAN STOVES

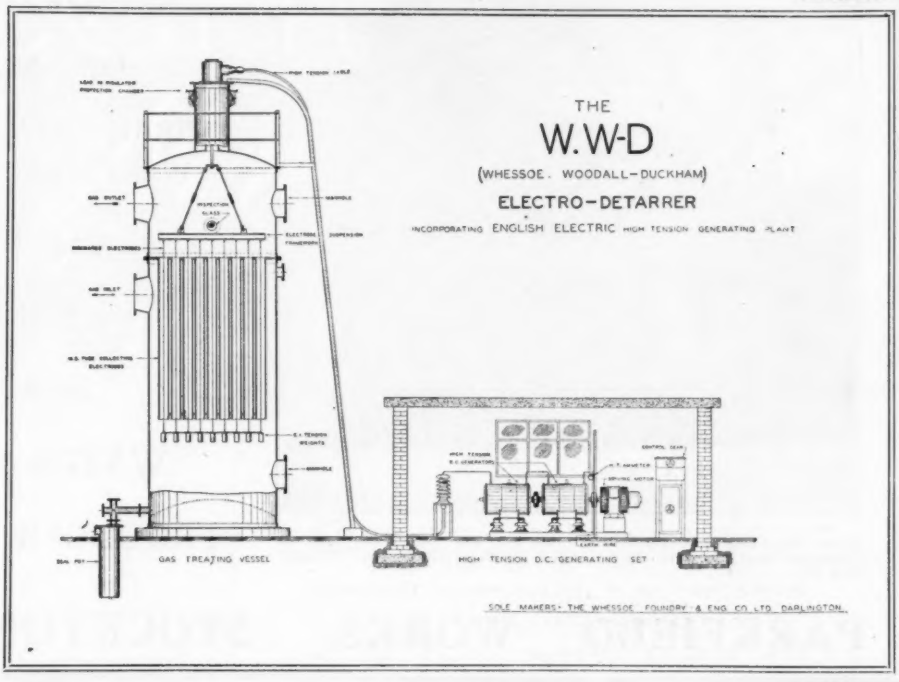
***The* VULCAN COOK BOOK**

Every housewife will want a copy of this inspiring Cook Book, as practical and attractive as the Vulcan Cooker itself. Send to us for a specimen copy and full particulars regarding this helpful sales aid.



THE VULCAN STOVE COMPANY LTD. EXETER

TAR FOG REMOVAL



THE W.W-D

(WHESSOE WOODALL-DUCKHAM)

ELECTRO-DETARRER*

The W.W-D Electro Detarrer is an improved method of tar fog removal from fuel gases—coke oven gas, coal gas and c.w. gas in particular. The W.W-D system incorporates English Electric H.T. generating plant and has a number of special features notably:—

1. Direct generation of straight line H.T. current, a fully protected system.
2. Special patented design of lead-in Insulator giving freedom from breakdown.
3. Maximum fog removal efficiency.
4. Minimum running costs.
5. Low capital cost for this type of plant.
6. Negligible back pressure.
7. Freedom from interference to wireless.

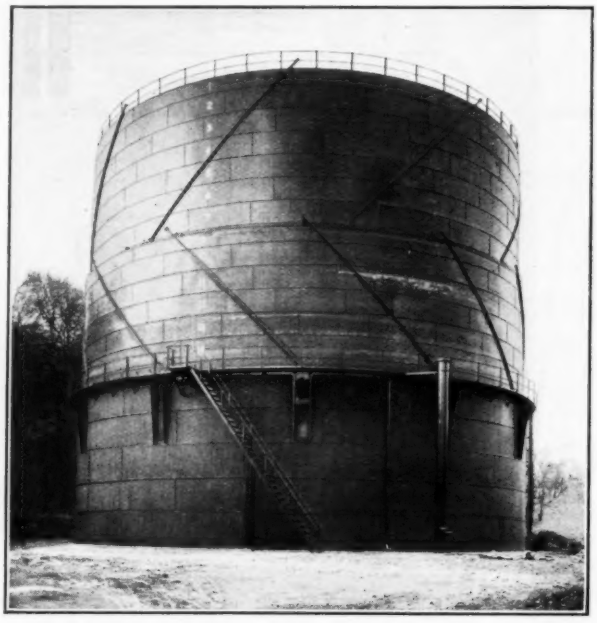
The W.W-D Electro-Detarrer is guaranteed to have an efficiency of tar fog extraction of over 98%, and in practice this figure is greatly exceeded—entire extraction being achieved. Fuller particulars will gladly be supplied.

* As supplied to the Nunnery Colliery Co., Ltd., Sheffield, N E. Webster, Esq., Managing Director.

ELECTRO W.W-D. DETARRER
WHESSOE WOODALL-DUCKHAM
INCORPORATING ENGLISH ELECTRIC HIGH TENSION PLANT

SOLE MAKERS:—**WHESSOE FOUNDRY & ENGINEERING CO., LTD.**
HEAD OFFICE & WORKS—DARLINGTON.

ASHMORE, BENSON, PEASE & CO., LTD.



2-Lift Spiral-Guided Gasholder. 250,000 c.ft. cap. with Steel Tank at Chester-le-Street for THE NEWCASTLE-UPON-TYNE & GATESHEAD GAS CO.
(*Frank P. Tarratt Esq., M.Inst.G.E., M.Inst.Gas E., Engineer.*)

MAKERS OF

GASHOLDERS

OF ALL SIZES

SPIRAL: STANDARD GUIDED:
WATERLESS (Klonne Patent)

CONDENSERS

PURIFIERS

SCRUBBERS

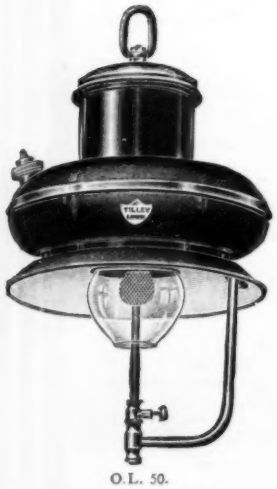
WATER-GAS PLANT

PRODUCER GAS PLANT

PARKFIELD WORKS, STOCKTON-ON-TEES

STREET LIGHTING IN COUNTRY DISTRICTS

OUTSIDE THE AREA OF GAS SUPPLY



O.L. 50.

Outdoor Suspension Lamp
300 c.p. 77/6
BRITISH MADE
THROUGHOUT

Street Lighting has frequently to be provided in districts where the cost of extending the gas service would be prohibitive. This difficulty can be overcome by installing Tilley Paraffin Vapour Lamps, which are self-contained and give an extremely brilliant light at almost negligible cost. We recommend—

THE TILLEY OUTDOOR SUSPENSION LAMP

Made in two sizes: 300 c.p. and 500 c.p.

BURNS ORDINARY PARAFFIN. WIND AND RAIN PROOF.

This method of lighting is being introduced by several Gas Undertakings with excellent results. The Lamps are very simple to manage and the cost of maintenance for 1000 burning hours (including paraffin) works out at considerably less than 20/- per Lamp. This is equivalent to—

4 HOURS LIGHT FOR 1d.

If required, we can supply a Lamp suitable for fitting inside existing lanterns.

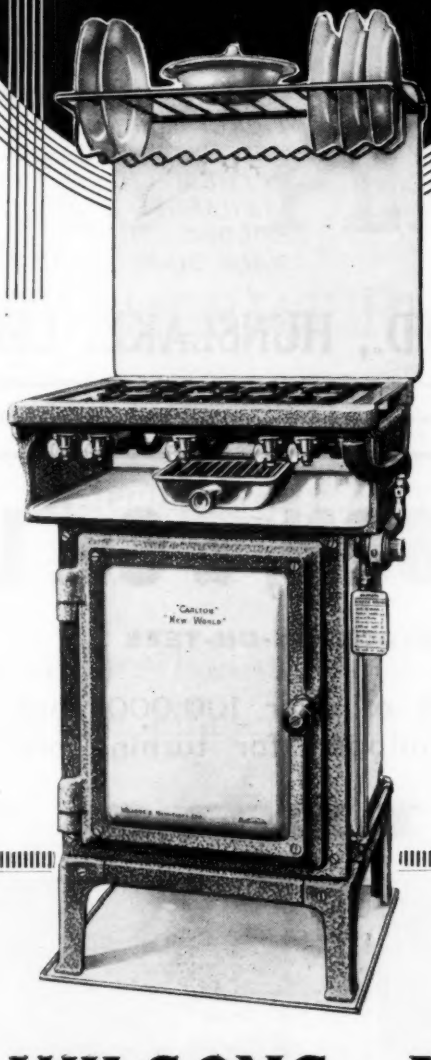
Widely used by the leading Railway Companies all over the World.

Sample Lamp for testing purposes willingly sent without obligation to purchase.

THE TILLEY LAMP CO., HENDON, N.W.4.

Telephone: Hendon 8045 (2 lines).

"Carlton"
"New World"
("REGULO"-CONTROLLED)



BY the most careful attention to every detail of construction and finish, throughout the whole production process, the "Carlton" "New World" cooker can be offered to Gas Undertakings as fully worthy of the Wilson tradition of thoroughness. Supplied with new season's improvements which include embossed door panel and sides, octagonal door handle, with chromium plated washers, covered hinge lugs and improved "Regulo" tablet.

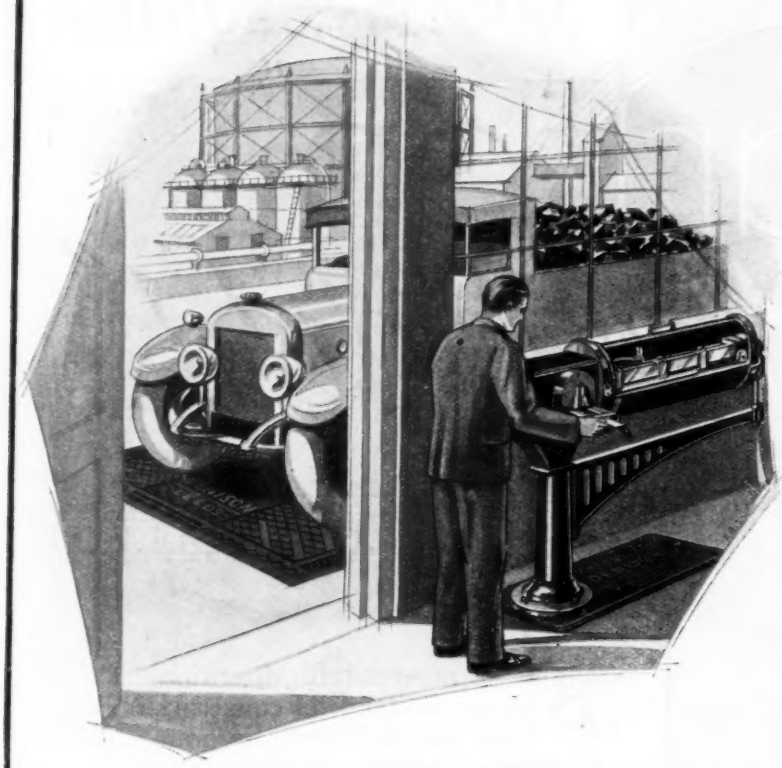
No pains have been spared to ensure a high-grade appliance; the well-known "New World" features are all incorporated; and the porcelain enamel finish is particularly bright and pleasing.

Illustrated descriptive price lists will be gladly sent on application as below.

WILSONS & MATHIESONS LTD

Carlton Works, Armley, Leeds

Radiation Limited Proprietors



Weigh-Books and Delivery Note Books are no longer necessary

Adopt the

"DENISON" TAPE & TICKET SYSTEM with equilibrium control

No more disputes, only accurate records can be made.

Weigh the load. Close cover. Insert ticket. Write the name. Pull handle.

YOU THEN HAVE A DELIVERY TICKET FOR THE DRAYMAN AND A COMPLETE RECORD IN THE MACHINE. THE TAPE IS CHANGED TO A SUITABLE HOLDER AND POSTINGS MADE DIRECT TO ACCOUNTS.

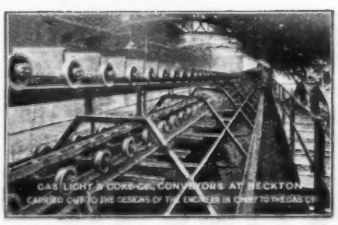
SAML. DENISON & SONS, LTD., HUNSLAKE, LEEDS

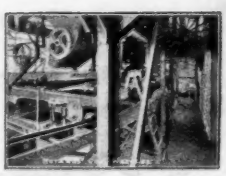
HEAD, WRIGHTSON, & Co., Ld.

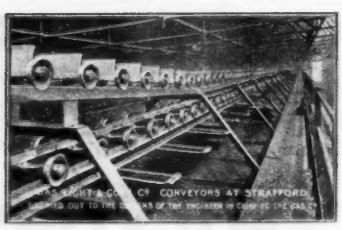
THORNABY-ON-TEES and STOCKTON-ON-TEES

have foundries with an output of over 100,000 tons annually and are specially equipped for turning out

PURIFIERS







GENERAL GAS PLANT

PUT US ON YOUR ENQUIRY LIST FOR STEEL CASTINGS

London Office: 5, VICTORIA ST., S.W. 1.

"HedWrit" Special Alloy Steels to suit all requirements.

EFFICIENCY AND RELIABILITY

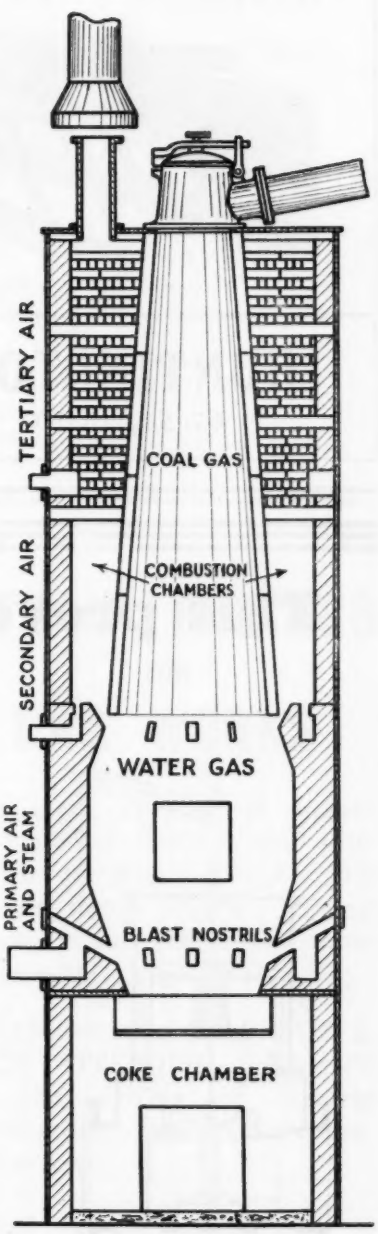
To improve your plant and increase your output at less cost

instal

THE MOORE GAS PLANT

140 THERMS PER TON
QUALITY — **400** B.Th.U.

Mechanically operated
All the usual Residuals



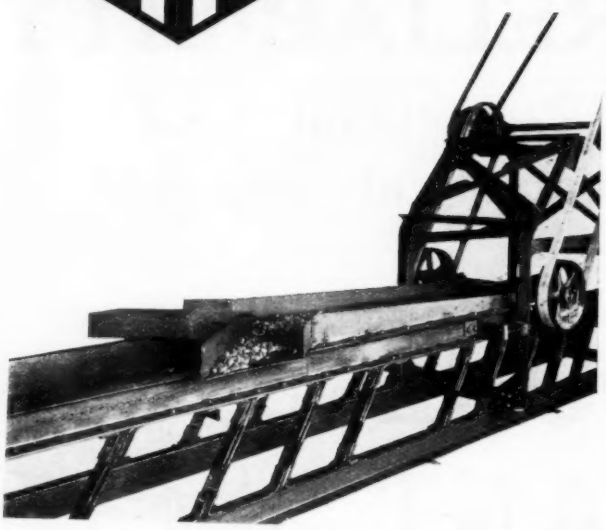
You need equipment which will operate efficiently at low cost.

The MOORE plant will increase the efficiency of your gas making and will reduce your depreciation and maintenance charges.

Full particulars on application to the sole licencees and manufacturers

ANDREW BARCLAY, SONS & CO., LTD.
GAS DEPARTMENT, CALEDONIA WORKS, KILMARNOCK

COKE SCREENS.



"H.H." Coke Screen at Wolverhampton Gas Works.

THE ONLY LOGICAL WAY IN WHICH TO SCREEN COKE IS TO SEPARATE THE LARGER SIZES FIRST AND TO ELIMINATE THE BREEZE LAST OF ALL. This is the method we adopt in the "H.H." Coke Screen, which is characterised by very high screening efficiency, over 95% being obtained in actual practice. The power consumption of this screen is much lower than that required for rotary screens, while the machine acts also as a conveyor, thus facilitating distribution of the graded products into bunkers. ***The only moving part is the shaft carrying the two unbalanced pulleys which actuate the screen,*** there being no cams, rockers, or other complicated parts to get out of order. These screens are built in lengths up to 25 ft., two or more screens being arranged in series where greater lengths are to be covered. Each screen is designed to suit the particular number of grades and the distribution required.

HUNTINGTON, HEBERLEIN & CO., LTD.
47-51, KING WILLIAM STREET, LONDON, E.C. 4.

This prevents Explosions & Fire!

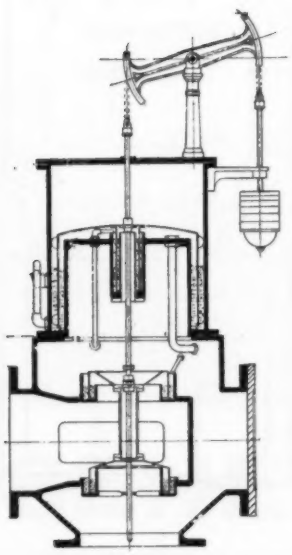


Fig. 65.

One never knows when a steam pipe is going to burst, an exhauster stop, or other part of the plant fail and cause a high back pressure in the foul main. This, in its turn, may result in explosion and fire—two things every Gas Engineer dreads.

Your best safeguard is Peebles' Automatic Safety Relief Valve. This definitely prevents any undue pressure in the retorts and the subsequent escape of gas.

Immediately pressure is relieved, the governor automatically reseals the Foul Main.

Peebles

AUTOMATIC SAFETY RELIEF VALVE

is a practical assurance against accident and stoppage and will make your works *safer*. It eliminates the human element entirely.

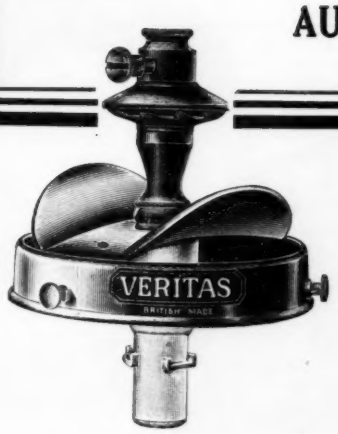
We have all standard sizes and will quote on hearing your requirements. Ask us to do so.

PEEBLES & CO., LTD., TAY WORKS, BONNINGTON, EDINBURGH.

VERITAS

AUTOMATIC AIR-SCREEN BURNER

PATENT



ONLY ONE SIMPLIFIED ADJUSTMENT REQUIRED

THE VERITAS AUTOMATIC AIR-SCREEN BURNER IS SO CONSTRUCTED THAT THE PUBLIC ARE ABLE TO HANDLE IT WITH EASE THUS

REDUCING YOUR MAINTENANCE CHARGES

PLEASE WRITE FOR FULL PARTICULARS

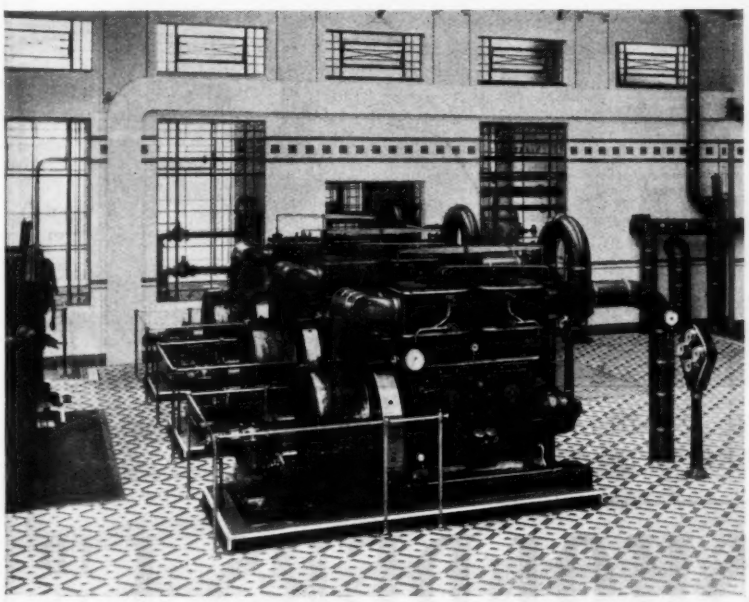
FALK, STADELMANN & CO., LTD.

83-93, FARRINGDON ROAD, LONDON, E.C. 1

GLASGOW, MANCHESTER, BIRMINGHAM, DUBLIN
NEWCASTLE-ON-TYNE, CARDIFF, LEEDS, LIVERPOOL

Works:

LONDON, S.W.; BIRMINGHAM; RAINHILL, LANCS.



Pass out Generating Sets at the Oldham Gas Works. Opened by H.R.H. Prince George, 8th May, 1933.

STEAM ENGINES FOR GAS WORKS

The large surplus of steam available in modern gas producing installations makes the use of steam engines for all power requirements the most economical proposition.

We specialise in PASS OUT & BACK PRESSURE ENGINES for the driving of Electric Generators, Fans, Conveyors, Stokers, etc.

ASHWORTH & PARKER

RIVERSIDE WORKS

BURY, LANCS.

Tel. Add.: "Kinetic, Bury"

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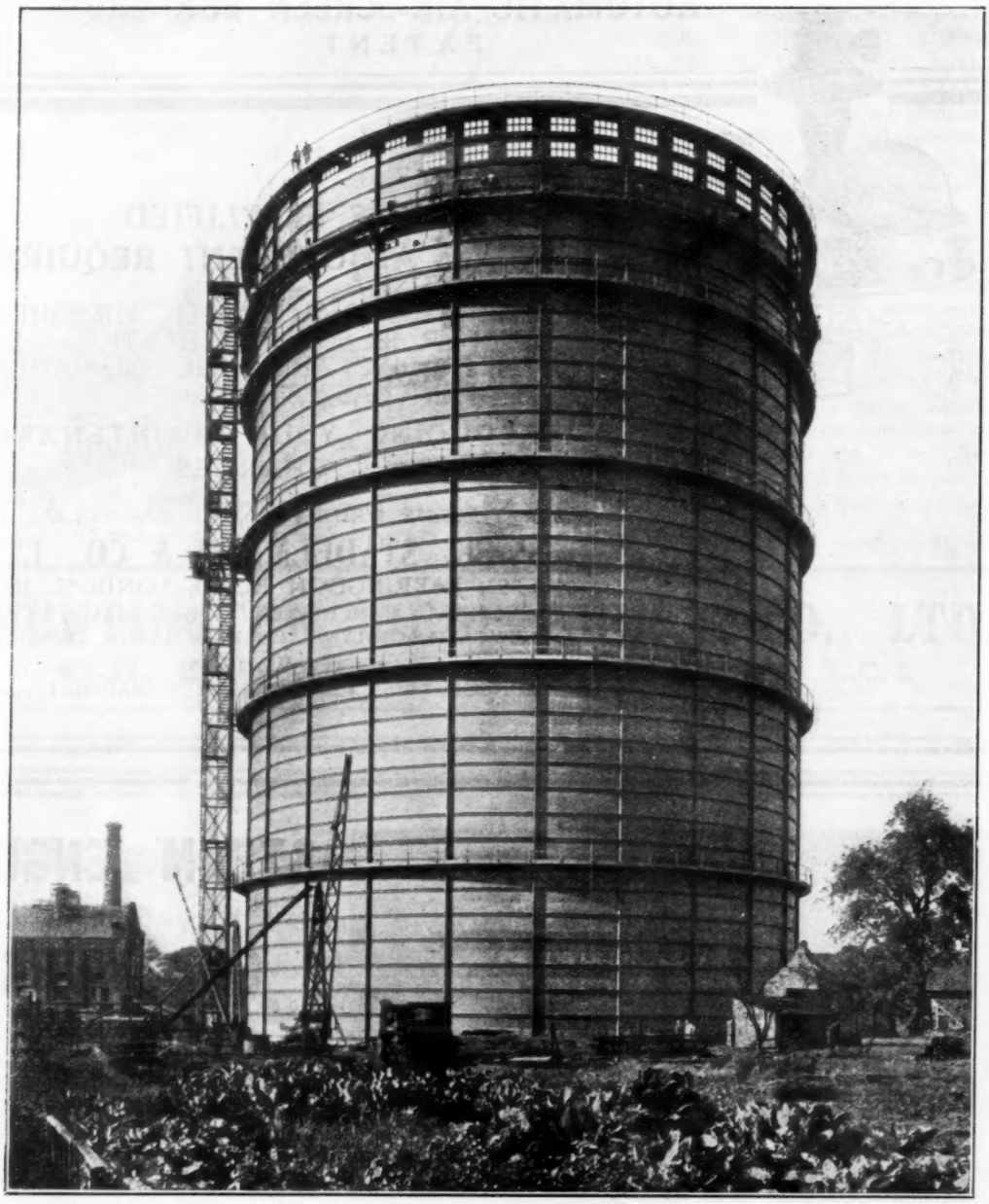

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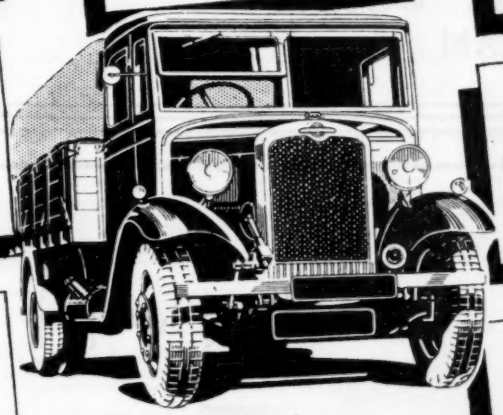

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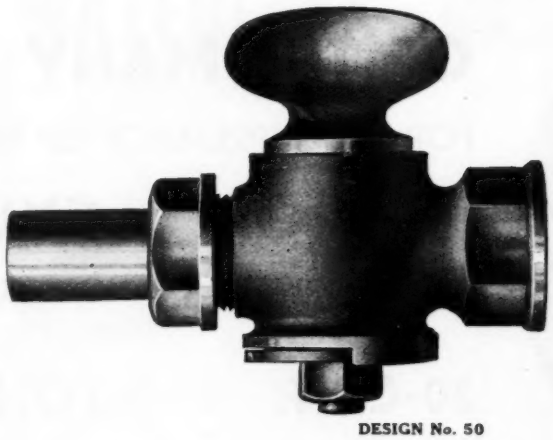

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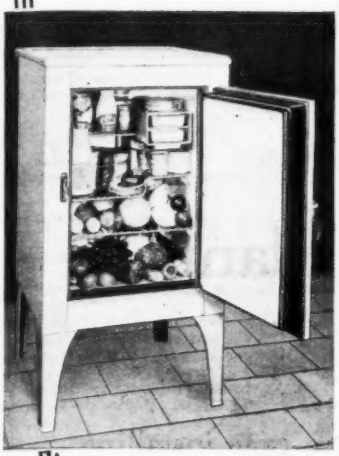

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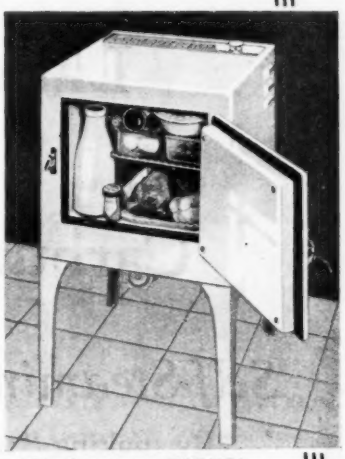

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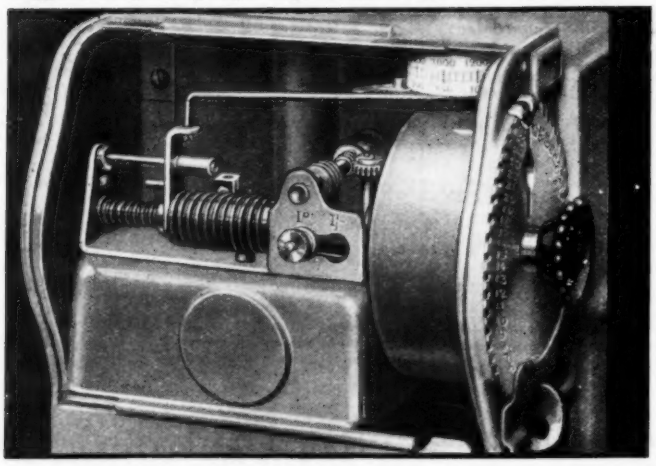

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THE GAS JOURNAL

MAY 10, 1933

Vol. 202. 85th Year No. 3651

A Glance at the Contents—

Bombay Gas Company, Ltd.

Satisfactory progress and a maintenance of last year's dividend in spite of the severe troubles experienced in the country during the twelve months were reported at the Annual Meeting of the Bombay Gas Company. [p. 337.]

I.G.E. Examination Questions.

The questions set in the Examinations in Gas Engineering and Gas Supply, which were held on April 29 and May 6 respectively, under the Education Scheme of the Institution of Gas Engineers, will be found on pp. 327-329.

Organizing for Leisure.

At the annual dinner of the Chemical Engineering Group of the Society of Chemical Industry, the principal speech of the evening was an address by the Rt. Hon. Lord Melchett on "Modern Economics and Unemployment," in the course of which he put forward a few of the ideas which he said had been passing through his mind during the past few years during which, in a rapidly changing world, entirely new sets of conditions had been arising which required entirely novel solutions. [p. 326.]

Preparation and Sale of Coke.

This is the subject of a paper by Mr. T. Hornby, of Hessle, before the North of England Gas Managers' Association on Friday last. Hessle is a small Company selling 61 million c.ft. annually, but Mr. Hornby has tackled the coke market wisely and is reaping due reward. From primitive practice he has evolved quite an efficient coke sales scheme. To-day he is selling graded coke with an ash content of about 5½% and a moisture content of 1%, and the average net price per ton he receives for it exceeds the cost of coal per ton into retort house. [p. 343.]

Reconstructed Gas-Works at Oldham.

The reconstruction of the Higginshaw Gas-Works forms the first stage of the Oldham Gas Committee's policy of centralizing the production at this works, and the inauguration of the reconstructed works by Prince George on Monday last marks an epoch in the progress of the undertaking. [p. 332.]

Flaking of Vertical Retorts.

In a paper which Mr. A. T. Green read at a meeting of the North of England Gas Managers last Friday, reference was made to the part played by scurf in the flaking of vertical retorts. He pointed out that scurf may play an important rôle in flaking. Adhesion of scurf, and the difference in its expansion and contraction from the expansion and contraction of the retort during operation, and particularly during the scurfing period, may well cause disintegration of the refractory surface. [p. 339.]

Modern Selling Policy.

On Thursday last Mr. W. B. McLusky, General Manager and Secretary to the Halifax Corporation Gas Department, addressed the Midland Junior Gas Association. He remarked that the average consumption per consumer supplied in this country is very low—not more than 3¾ c.ft. per customer per hour. That is to say, if every customer on our books had one lighting fitting *and nothing else*, and allowed that lighting fitting to remain in full use throughout the 8760 hours in a year, the present average hourly consumption of 33,000 c.ft. of gas per customer per annum would be maintained. Are we, he asked, content with this small amount of business? [p. 330.]

Forthcoming Engagements

May 11.—S.B.G.I.—Meeting of Council, 10.30 a.m.

May 11.—SOCIETY OF BRITISH GAS INDUSTRIES.—Annual General Meeting and Dinner, Hotel Metropole, London.

May 11-12.—EASTERN COUNTIES ASSOCIATION.—Half-Yearly Meeting at Croydon.

May 13.—SCOTTISH JUNIOR GAS ASSOCIATION (EASTERN DISTRICT).—Annual General Meeting at Edinburgh.

May 16.—I.G.E.—Meeting of Gas Appliances Sub-Committee, 2.30 p.m.

May 17.—B.C.G.A.—Meetings of Executive Committee, 11 a.m.; General Committee, 2.30 p.m., 28, Grosvenor Gardens, S.W. 1.

May 18.—WALES AND MONMOUTHSHIRE ASSOCIATION.—Meeting at Abertillery.

May 19.—SOUTHERN ASSOCIATION.—Meeting at Bridgwater.

May 19.—MANCHESTER DISTRICT ASSOCIATION.—Special Meeting at Leeds.

May 20.—YORKSHIRE JUNIOR ASSOCIATION.—Meeting at Leeds. Paper by Mr. W. E. Benton.

May 25.—MIDLAND ASSOCIATION. — Spring meeting at Stafford.

May 29.—I.G.E.—Meetings of Finance Sub-Committee, 2 p.m.; Finance Committee, 2.30 p.m.; Executive Committee of the Council, 3 p.m.; Council, 4 p.m., Liverpool.

May 30-June 2.—I.G.E.—Annual General Meeting, Liverpool.

June 12.—I.G.E.—Meeting of General Research Committee, 2.30 p.m.

June 13.—I.G.E.—Meeting of Gas Education Executive Committee, 4 p.m.

June 14.—ASSOCIATION OF STATUTORY INSPECTORS OF GAS METERS.—Annual Meeting in London.

June 15.—I.G.E.—Meeting of Refractory Materials Joint Sub-Committee, Stoke-on-Trent, 2.30 p.m.

May 24.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS (EASTERN DISTRICT).—Meeting at 28, Grosvenor Gardens, S.W. 1, 2.30 p.m. Subject for discussion, "Enamelling of Gas Cookers and Fires."

June 28.—I.G.E.—Board of Examiners; Oral Examinations, 9.30 a.m.

June 23.—WAVERLEY ASSOCIATION.—Annual Meeting in Edinburgh.

Sept. 7.—NORTH BRITISH ASSOCIATION.—Annual Meeting in Paisley.

EDITORIAL NOTES

A Students' Fund

IN more than one respect, it may be said that last week's Annual General Meeting of the North of England Gas Managers' Association was notable. Experience in connection with meetings of Associations of this character often is that many members are obliged to leave close upon the conclusion of the business proceedings, and that, unless there are facilities provided for getting together beforehand, the opportunity for that personal contact which is so potent for good is liable to be circumscribed. Mr. A. C. Hovey, who has been President of the North of England Association during the past year, realized the importance of increasing the possibilities of intercourse between the members, and, as a consequence, on Friday last in the County Hotel, Newcastle-upon-Tyne, there was at mid-day a Presidential reception, during which Mr. Hovey was able to greet every member attending, and friends could form themselves into groups for the discussion of matters of personal interest. An informal lunch followed, with an attendance which must have proved peculiarly gratifying to the President and all who had supported him in the arrangements for this part of the day's proceedings.

But this was not all. Mr. Hovey had in readiness another big suggestion for forwarding a good cause, and this he brought to the notice of the members quite early in the afternoon's business. This suggestion was that a " Students' Fund " should be formed, for the purpose of assisting and encouraging in their work the students of the Association. This will be " wise spending " indeed. The Association are well able to afford the capital sum of £250 which Mr. Hovey suggested should be allocated to the foundation to the Fund, and to this he has generously added another £250 from his own pocket. Thus the Fund will start with the interest on £500 as its income, though we hope, with the President, that nothing will be permitted to discourage additions to this amount. Mr. Hovey's experience has led him in the direction in which experience should lead us all—towards sympathy with the younger men whose difficulties lie ahead of them instead of behind them. There are various ways in which such a Fund may be utilized, but whatever is decided upon the students will be greatly encouraged by this practical interest in their welfare. The proposal brings to mind the good work that is done by the Wales and Monmouthshire Association in encouraging the Juniors by awarding prizes for successful effort.

Research on Refractories

A QUARTER of a century has passed since the formation of the Refractory Materials Sub-Committee of the Institution of Gas Engineers and the Society of British Gas Industries, and thirteen years since the setting-up of the British Refractories Research Association. Co-operation between these two bodies has resulted in great benefits to the Gas Industry and to the manufacturers of refractory materials, and it is gratifying that it became possible last year to extend the scope of the researches—a matter in which our Industry played a courageous part. If anyone doubts the wisdom of this added support, his doubts will be dispelled when he reads in our columns today the outline by Mr. A. T. Green of the work of the Joint Sub-Committee and the B.R.R.A. in furthering the study of refractory materials during the past decade.

Mr. Green first discusses the Joint Committee's standard specifications for gas-works refractories, drawn up as early as 1912 and modified in the light of new knowledge in 1922 and 1925. These specifications have been instrumental in effecting progress in many ways. There can be no doubt, for instance, that the application of the after-contraction or expansion test has been of the greatest value to the Gas Industry. It has resulted in an improvement in the texture of firebricks and silica products and an increase in the maximum temperature of the firing operation; and it has helped to pave the way to a fuller appreciation of the constitution of silica products. Again, there can be no doubt that the application of the test for refractoriness has resulted in improvement in the texture of the commoner refractories, which has reacted favourably on their durability in practice. The author emphasizes, however, that there are many aspects of the mechanical properties of refractory materials at high temperatures which have received little or no attention, and that a wide field needs to be explored. In the main, stability at high temperatures has been investigated from the viewpoint of one test; its broader and more fundamental significance calls for considerable study.

Research on thermal conductivity, temperature diffusivity, specific heat, and heat capacity of silica, fireclay, and magnesite products carried out during the past ten years has had its bearing on retort setting and furnace design and has led to higher efficiencies. Study of the thermal properties of refractory materials was followed by investigations of the properties of insulating materials and an extended exploration of their application to retort settings. It has been shown how desirable is a preconceived disposition of insulating materials based on an appreciation of their properties, the behaviour of the refractory in the setting, and the peculiarities and functions of the plant, and it has also been demonstrated that insulation as an afterthought requires very careful consideration—as those engineers well know who have applied insulating material to retort tops and to the outer walls where the setting was previously running in an uninsulated condition. Mr. Green mentions that when design involves external insulation there are strong arguments for building-in the insulating brickwork after the setting has attained working temperatures. This work and the investigations of other research workers stimulated greater interest in the subject of insulation and gave a lead in the assessment of the desired properties of diatomite insulating bricks. Recently it has been proved that the diatomite product, in spite of its high porosity, has a very low value for the permeability to gases, a property which must be of value in a furnace structure.

The remarks of Mr. Green on the part played by scurf in the flaking of vertical retorts are of much interest. He points out that scurf may play an important rôle in flaking. Adhesion of scurf, and the difference in its expansion and contraction from the expansion and contraction of the retort during operation, and particularly during the scurfing period, may well cause disintegration of the refractory surface. Again, experience with different retorts carbonizing different coals suggests that the nature of the scurf varies considerably with the coal used and the carbonizing conditions. For instance, the tenacity with which the scurf is held to the surface varies in different settings. It is also possible that the thermal volume changes of the scurf also vary with its nature. The phenomena associated with the formation and rate of growth of scurf require careful definition, and it is probable that some variation in the method of scurfing may reduce the flaking of retorts. The author clearly proves that our progress must be in direct proportion to our application of the " unsentimental thoroughness of scientific research."

Coke Selling

IN our columns this year there has been plenty of evidence that the public will buy gas-works coke if that coke is properly prepared for the market, graded into sizes suitable for different requirements. It is definitely an economic proposition, for works of any size, great or small, to spend money on coke preparation. In March last Mr. T. H. Poulson, of Stafford, urged those

responsible for the policy of small undertakings to pay immediate attention to the question of installing coke screening plant, and he explained that, as a result of installing coke grading and handling plant, his own Undertaking has saved a matter of £13,000 during the past thirteen years. More important even than this monetary return, however, is the fact that during this period, through efficient supply of good coke of the correct grade, he has developed goodwill and built up an excellent market. Also in March, Mr. G. Dixon, of Nottingham, told us that, thanks to similar care in coke marketing, not only is there a good demand, but his Undertaking has to refuse orders daily. The position is, in fact, "embarrassing." Stafford and Nottingham are large undertakings, but last month Mr. J. H. Cornish, of Bridgwater—a Company making 153 million c.ft. of gas a year—said that the coke he sells is readily absorbed in his own area, and that here again the demand is greater than the supply. The reason is the same.

"Preparation and Sale of Gas Coke" is the title of a paper which Mr. T. Hornby, of Hessle, read before the North of England Gas Managers' Association last Friday, and it is published in the "JOURNAL" to-day. Hessle is a small Company selling 61 million c.ft. annually, but Mr. Hornby has tackled the coke market wisely and is reaping due reward. From primitive practice he has evolved quite an efficient coke sales scheme. Twenty years ago, when he took up his duties there, the idea was to sell coke by the sack, at 5d. a time, without defining the sack. Physical strength of the customer was thus at a premium, and the man who could carry a bed-tick full of coke certainly got heat units cheaply. It is not difficult to imagine the dismay of customers when he decided to sell by weight and not by measure of the muscular ability of the buyer. But he stuck to his guns, watched much of his custom diminish, and set about to remedy this decline. His story, simply told, makes good reading. Starting at the right end, he determined to buy coal of low, and constant, ash content; and we thoroughly agree with him that it pays to buy a clean coal which will make a satisfactory coke. As a result of his efforts, he is now sure of a supply of coal which will produce a coke of uniformly low ash content; actually he buys his coal under a penalty clause for ash in excess of 5%, and the average ash during one contract period was very much below this figure.

Domestic Trade

BEFORE very long Mr. Hornby obtained as many coke customers as he could supply, but it became apparent that he would be unable to hold this market unless he offered sized and graded coke, and the substance of his paper is how he installed coke breaking and screening plant and the results of its operation. To-day he is selling graded coke with an ash content of about 5½% and a moisture content of 1%, and the average net price per ton he receives for it exceeds the cost of coal per ton into retort house. And, of course, his customers are satisfied. In regard to sales methods in Hessle, at intervals printed leaflets are sent out giving prices, special circulars are sent to large customers, collectors and fitters book orders, and a canvasser is employed on the work. A steady domestic trade is being built up by these means, which are backed up by showroom demonstration. His adoption of "bag trade" is wise. Many small undertakings can learn a good deal from Mr. Hornby's paper, and we hope that his attitude regarding coke sales, which is proved by results to be the right one, will be an incentive to others to adopt better business methods in selling coke—after gas the most important product of our Industry. It cannot be too often reiterated that neglect of the coke market means higher gas prices and hence limits its use.

It is unfortunate that Mr. Hornby has not been able to induce local shopkeepers to stock bags of coke. The bags he offers to shopkeepers hold 2 stones of coke and sell at 7½d. We suggest that this size of bag is too large. In Halifax, one hundred and forty shopkeepers sell gas coke in 3d. bags, and the number of 3d. bags sold over the counter last year was no less than 231,121. The fact that nearly a quarter of a million bags can be sold over shop counters in one year in a town of less than 100,000 inhabitants shows that there is a substantial demand for a good fuel to be purchased in this way. Apart from counter sales, Mr. W. B. McLusky, the Engineer and Manager of the Gas Department, has arranged to deliver coke direct to consumers in three sizes of bags, at 1s. 3d., 10d., and 6d. each. This range of choice should have a strong appeal, and it will be interesting to see the effect of the introduction of the 6d. bag, which is new. Of the 1s. 3d. bags, 104,857 were sold last year.

The Tax on Fuel Oils

A GREAT deal of correspondence has been published in recent issues of *The Times* on the effects of the tax of a penny a gallon on imported fuel oil, and this correspondence is likely to enlighten manufacturers and industrialists regarding the merits of town gas and coke for central heating and general industrial and large-scale commercial purposes. It is obvious from some of the letters that many people are quite unaware of the developments which have taken place during the past decade in gas-fired and coke-fired equipment—developments which, it can be proved, place these two smokeless fuels (particularly gas) in a position to compare favourably with oil from the point of view not only of efficiency, but of cost. One correspondent, returned from a prolonged tour of the Rhine and Ruhr, found over there that the use of fuel oil is almost non-existent. Also, raw coal has ceased to be regarded as an industrial fuel at all. It is looked upon simply as raw material for the electricity, town gas, and metallurgical coke industries.

It is indeed difficult to understand why industrialists should employ imported fuel oil when they have at their command equally efficient, equally, or more, economical, home-produced smokeless fuels, the use of which has such a beneficial influence on Great Britain's basic industry—coal. It is argued that manufacturers of oil-burning equipment will suffer. It is apparent, however, that any such suffering will be offset by increased employment in the production of plant for burning gas or coke, and increased employment in the mines. The oil enthusiasts have, in fact, a case which it is difficult to justify on any grounds. On balance, imported fuel oil involves damage to important national industries, and those who incurred capital expenditure on fuel oil installations did so at their own risk. They should follow the lead given by Sir William Morris, who, as was noted in the "JOURNAL" for April 19, during the last twelve months gave a contract for 100 million c.ft. of gas to be used instead of oil at his works in Birmingham—a change-over which is taking place throughout his organizations.

Mr. R. W. Foot, Chairman of the London and Counties Coke Association, dealt with the matter clearly in two letters in *The Times* last week. It is evidently not known, he said, that material advances have taken place in the application of coke to heating; and he pointed out that the fuel has been improved and so has the plant. Thermostatic control and other modern aids to efficiency are now possible when coke is used for central heating and for industrial heat processes. Users of coke can be assured of an economical and smokeless fuel which, when burned in suitable apparatus, reduces to a minimum the physical disadvantages hitherto associated with the use of a solid fuel. At the same time there are thousands of industrial processes and of central heating installations for which gas is preferred, and technical improvements in this field have also been remarkable. Users of fuel oil who fear an addition to their costs in consequence of the Budget will find that, by changing over to modern methods of coke or gas heating, their fears are unfounded. Moreover, owners of oil-fired plant who anticipate a heavy capital charge if they change to coke or gas are under a complete misapprehension.

It is a sign of the growing appreciation of the merits of gas as a fuel for motor vehicles that the Budget has given encouragement to its use on heavy commercial vehicles. This preference will assist in the development of this new use for highly-compressed town gas.

PERSONAL

HORNSEY'S NEW SALES MANAGER.

Mr. Herbert Wilde, Deputy Showrooms Manager to the Bradford Corporation Gas Department since 1920, has been appointed Sales Manager to the Hornsey Gas Company, where he takes up duty in the course of a few weeks. Mr. Wilde, a native of Queensbury, near Bradford, is well known on the sales side of the Gas Industry in Yorkshire. He began his association with gas at Birkshall Works, Bradford, in 1908, and two years later was transferred to the Gas Engineer's office at the Town Hall. He saw service in the war from 1915 to 1919, being awarded the Meritorious Service Medal in France in 1917. An enthusiast in Gas Industry organization, he became Assistant Hon. Secretary of the Yorkshire Junior Gas Association in 1921, and has been Hon. Treasurer of that body since 1923 to the present time. He was the foundation Hon. Secretary, in 1923, of the West Riding Gas Salesmen's Circle, and retains that Secretaryship. Since 1926 he has been Hon. General Secretary of the Bradford Publicity Club; was an appointed speaker at the Hastings Advertising Convention in 1930; and has been a member of the Council of the Advertising and Publicity Clubs of Great Britain since 1931. In 1931, also, he was the Hon. Secretary of the Publications Committee in connection with the big Bradford Historical Pageant.

* * *

Mr. F. Cooper, Distribution Superintendent to the Leeds Gas Department, has been given the additional duty of supervising transport, at an increased salary.

At St. Leonard's Church, Hythe, Colchester, on Wednesday last, the marriage took place of Miss Betty Townsend, daughter of Mr. and Mrs. W. W. Townsend, of Colchester, and Mr. Frank Dawson, son of Mr. and Mrs. C. G. Dawson, of Paignton.

* * *

On his leaving to assume the management of the works of the Melrose Gas Company, Ltd., Mr. Robert J. Gavin was presented by the staff and employees of the Kirkcaldy Gas Department with a set of drawing instruments. Mr. Kincaid, Engineer and Manager, presented the gifts.

* * *

Mr. Alan Chorlton, C.B.E., M.P. (President of the Institution of Mechanical Engineers), and Dr. F. S. Sinnatt, M.B.E. (Director of Fuel Research), have been appointed by the Prime Minister to represent H.M. Government as Official Delegates at the Sectional Meeting of the World Power Conference to be held in Sweden, Denmark, and Norway between June 26 and July 8, 1933. The British National Committee of the World Power Conference are entitled to nominate three additional Official Delegates. Their choice has not yet been made.

* * *

The Edinburgh Town Council at their meeting held on Thursday last unanimously confirmed the recommendation of the Gas Committee that Mr. James Jamieson should be appointed Engineer and Manager to succeed Mr. H. H. Gracie when he retires in the autumn.

* * *

The City of Stoke-on-Trent Gas Committee at their last meeting appointed Mr. I. Greenwood, of Burnley, to be Sales Manager at a salary of £375 per annum. Mr. Greenwood is at present Showrooms Manager and Internal Fittings Superintendent to the Burnley Corporation Gas Department.

THE NEWS OF THE WEEK

The Price of Gas in Dunbar has been reduced from 5s. to 4s. 7d. per 1000 c.ft.

£1250 in Taxation has to be paid by the Birkenhead Gas Committee on their stock of 300,000 gallons of heavy oil under the Budget. This represents about 50% of the cost of the oil.

Institution of Chemical Engineers.—A meeting of the Institution will be held at 6 p.m. on Wednesday, May 24, at Burlington House, Piccadilly, W. 1, when Messrs. E. W. Colbeck, W. E. MacGillivray, and W. R. D. Manning will present a paper on "The Mechanical Properties of Some Austenitic Stainless Steels at Low Temperatures."

The First Gas Exhibition ever held in Milford Haven, promoted by the Milford Haven Urban District Council, was opened recently in the Masonic Hall, Milford Haven, by the new Chairman of the Council, Mr. W. G. White. He was supported by a number of Councillors and the Town Clerk, who was responsible for the organization of the event. There was a large attendance at the opening session. Lectures and cookery demonstrations were given by Mrs. E. Cox and Mrs. F. James.

An Invitation has been Extended by the Gas Light and Coke Company to members and friends of the Institution of Engineers-in-Charge to visit their works at Sands End Lane, Fulham, S.W. 6, on Saturday, May 13, at 2.30 p.m. The itinerary will include a tour of the works, an examination of the coke preparation plant, the new central heating apparatus, the Central Research Laboratory, and improvements in coke boiler-feeding appliances. Tea will be served at the conclusion of the tour.

The Annual Distribution of Prizes of the Westminster Technical Institute will be held at the Horseferry Hall, Horseferry Road, S.W. 1, on Tuesday next, May 16, at 7 p.m. The chair will be taken by Sir Francis Goodenough, and the prizes will be distributed by Mr. L. St. L. Pendred, who will give an address on Trevithick.

Gas Supply in the Argentine.—According to figures lately to hand the output of gas from the works of the Compania de Gas de la Plata during the past year amounted to roundly 87,124,000 c.ft., as compared with 83,955,000 c.ft. in 1931—an increase of 3,169,000 c.ft., or approximately 3·65%. The number of consumers during the twelve months increased from 4132 to 4307. The report of the Compania Explotadora de Usines de Gas de Bernal, a suburb of Buenos Aires, shows that the output increased from 43,782,000 c.ft. in 1931 to 45,791,000 c.ft. last year, over 4·5%. During the same periods the number of consumers advanced from 2142 to 2167.

Satisfactory Working Results are reported by the Directors of the Colombo Gas and Water Company, Ltd., in their report for the year ended Dec. 31 last. There is a balance of net revenue amounting to £18,835, which it is recommended should be appropriated as follows: To pay a dividend at the rate of 7% per annum on the 7% preference shares (subject to deduction of income-tax), less 3½% paid as interim dividend; to pay a dividend at the rate of 10% per annum on the ordinary shares (subject to deduction of income-tax), less 5% paid as interim dividend; and to add to general reserve the sum of £1000. These appropriations leave £12,030 to be carried forward to the next account.

South-Eastern Gas Corporation, Ltd.

Offer to Tunbridge Wells Gas Company Becomes Effective.

The South-Eastern Gas Corporation, Ltd., announces that its offer to the stockholders of the Tunbridge Wells Gas Company has become effective, acceptances having been received in respect of approximately 70% of the sliding-scale stock and over 60% of the 5% maximum stock.

Gas for South Wales Industries.

Setting-Up of Development Committee.

At Cardiff on Thursday last there was a meeting of the Industrial Centre, at which fourteen members were present. The meeting was primarily convened for the purpose of obtaining the views of members as to whether it might be advisable, in the interests of the Centre, to set up a Special Development Committee. After a short discussion, it was unanimously agreed that a South Wales Area Industrial Centre Development Committee be set up, comprised of present members representing the contributing undertakings, together with other nominated person or persons attached to these undertakings.

It was also agreed that, to commence with, this Development Committee should meet at bi-monthly periods, for the purpose of discussing the various reports sent up from the Centre, together with any other matters appertaining to the further development of industrial and commercial gas usage.

It was also unanimously agreed that contributing undertakings should be asked to send in to the Centre particulars of any job or jobs which they had successfully tackled within their own district, to keep the Centre advised of these successes, and also enable the Centre to circularize this information to the other Centres in the country.

A visit of inspection was then made to the Physical Laboratory of the Cardiff Gas Light and Coke Company, where a large-scale experiment is being developed in connection with the conversion of solid-fired bakers' ovens to gas-fired ovens.

Suggested Trials of Gas-Driven 'Buses at Accrington.

The Accrington District Gas and Water Board have instructed their General Manager to approach the Transport Committee of the Accrington Corporation with a view to the Committee giving consideration to a trial period of running one or two single-deck 'buses by gas. The suggestion is that the compressing plant and filling station equipment be provided by the Board, and the conversions of the engines, &c., of the 'buses be undertaken by the Corporation.

Councillor Snell, the Deputy Mayor of Accrington, said if it became universal to run motor vehicles on coal gas one could visualize the re-opening of many pits, the employment of many thousands of miners who were now out of work, and a very big increase in the number of men employed in industry for making cylinders of high-tensile strength steel for this purpose.

As a result of the Budget a 32-seater omnibus which now paid a tax of £57 12s. would, on and after Jan. 1 if run by coal gas have to pay a tax of £72—an increase of £14 8s. With a double-decker omnibus the increase in taxation was something like £30. He felt sure the Institution of Gas Engineers and the National Gas Council would look carefully into the matter and make all possible protests against an increase in taxation.

Advertising Convention Programme.

The Rt. Hon. J. Ramsay MacDonald, the Prime Minister, will open the 1933 Advertising Convention on July 18. Major the Hon. J. J. Astor, M.P., will be in the chair.

The Convention, the theme of which, "Advertising and World Recovery," is announced by Mr. C. Harold Vernon, Chairman of the Convention Committee, will occupy four days—July 18-21.

Others who will speak at the opening session will include the Hon. Robert Brand, C.M.G., and the Rt. Hon. Stanley Bruce.

On the following day the morning session will deal with Home Trade, and will be organized by the Incorporated Sales Managers' Association. Sir Francis Goodenough will preside.

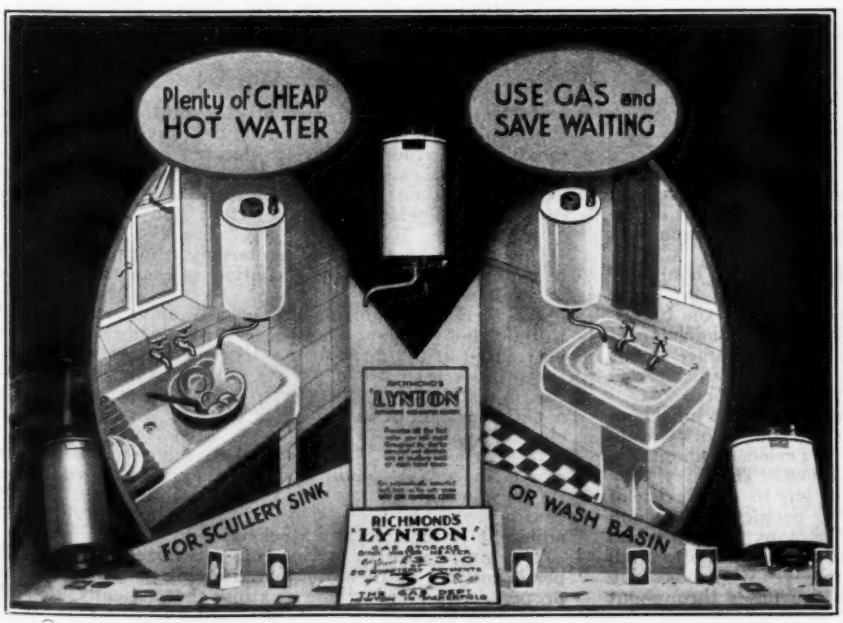
On Thursday, July 20, the morning session will deal with Overseas Trade, when the chair will be occupied by the Rt. Hon. Lord Riddell, a Vice-President of the Advertising Association.

Every afternoon during the Convention group meetings will be held dealing with advertising and merchandising problems.

Apart from the business sessions, an excellent social programme has been arranged, commencing with the formal Reception of all Convention delegates on the evening of Tuesday, July 18. This will take place at Hurlingham, by the courtesy of the Committee of Management.

On Thursday the Official Banquet will take place at Grosvenor House, at which the guest of honour will be the Rt. Hon. Walter Runciman, President of the Board of Trade. This will be followed by a Ball organized by the London Advertising and Publicity Clubs.

On Friday the lady delegates to the Convention and overseas visitors will be entertained at a Garden Party at Hever Castle, by invitation of Major the Hon. J. J. and Lady Violet Astor.



The Newton-in-Makerfield Urban District Council Gas Department has recently concluded a fortnight's intensive campaign in connection with the sale of Richmonds "Lynton" sink heater. The Gas Department has placed this popular heater on five years' hire purchase at 3s. 6d. per quarter, fixed free. One of the features of the campaign was the renting of a shop in the centre of the town where a special display was arranged and attracted much attention. A good business in gas water heating equipment is being steadily built up in this town as a result of this enterprising effort.

THE NEWS—continued.

Introducing Mr. Therm.

Mr. Therm. What is all this about Mr. Therm? Who is Mr. Therm? There can be few people to-day who do not know Mr. Therm well by sight—that cheery little figure with a winning smile who beckons us to inspect all the latest gas appliances and learn what wonders he can perform in them. Probably comparatively few, however, are intimately acquainted with Mr. Therm and his wondrous works.

So the British Commercial Gas Association, in support of the excellent national publicity at present featuring Mr. Therm, have published a most entertaining little booklet introducing him to the public and explaining just what he stands for and all that he can do. A number of amusing illustrations show Mr. Therm at work in his various capacities in the home—dancing a jig upon the hearth of a gas fire; seated on a radiator; about to "step into hot water;" doing a little laundry work; switching on the gas light at dusk; cooking for the household; frozen up in the gas refrigerator, but cheery as ever in spite of it; and finally doing a few odd jobs about the house with such gas "gadgets" as curling iron heater, poker, and toaster. Whatever he is depicted as doing, Mr. Therm revels in it, radiating cheerfulness and efficiency.

In explanation of what Mr. Therm is and what he does, the booklet says that there is no mystery about him. He is the warm friend of everybody who needs heat on tap. "The Therm is a State-established measure of heat, as definite and unalterable as the pound weight, the yard, or the pint." A new proverb brought out by the booklet is "Happy homes have Therms on tap." "Cold water," says Mr. Therm, "is all very well for fishes, but it is out of place in the hot water tap. Before I came on the scene," he adds, "most taps that called themselves HOT did not live up to their label." Mr. Therm is the terror of cold water. It can't stand him. It goes hot all over when he comes near it. He is also the warm friend of doctors; three out of every four have taken him into their homes. Mr. Therm doesn't care if it rains on washing day. He will dry the clothes himself in his little cabinet and air them too. At dusk every night Mr. Therm sallies out to do a big job of work in the streets, and at the same time he switches on the gas light in millions of houses. Mr. Therm is a warm subject as a rule. But he can change his climate at will. He is the man to work a refrigerator.

In similar strain the booklet describes many more tasks that Mr. Therm can perform in the house, and at the conclusion of each section it is pointed out what one therm of gas will do in each of its respective functions. On the last page he proudly announces, "Now you know who I am and a few of the things I do," and, with a confident gesture, he invites the reader to step in and see him at work in the gas showrooms.

Altogether this little booklet, which is entitled "All About Mr. Therm," makes most interesting and entertaining reading, and admirably succeeds in setting out simply and clearly just what the therm is and what it does. In fact, it ably introduces Mr. Therm to the public who know him so well by sight but who little realize all that he can do for them.

Swindon to Extend Gas Mains.

A step towards the modernizing of social conditions in the villages and hamlets around Swindon was taken on May 2 when work was commenced on the extending of the Swindon United Gas Company's mains into Hodson and Chiseldon.

The first sods were cut at the crossing of the boundary near the Bird Sanctuary, Coate Water, the ceremony being performed by Mr. A. E. Chandler, Chairman of the Chiseldon Parish Council, and Major F. G. Wright, Chairman of the Swindon United Gas Company, in the presence of his co-Directors, Mr. Cecil H. Chester, General Manager and Secretary, and a number of the Parish Councillors.

Subsequently the company was entertained at luncheon, when Major Wright explained that the new work would mean employment for 40 men over a period of about ten weeks, at a cost of approximately £7000. That day they had cut the first turf for a supply of gas to the Parish of Chiseldon. In a few weeks' time the people of Chiseldon and Hodson would be able to enjoy the many privileges and labour-saving appliances gas brought and would go to swell the number of 7,000,000 English housewives who cooked by gas. Gas would be available for all purposes throughout the parish at very reasonable rates, and he mentioned that the price of gas had been reduced during the past year by 10%, and would be still further reduced as the output still further increased.

The Directors would be putting into operation on Oct. 1 next a scheme whereby for a small quarterly payment of 10s. only gas would be obtainable at 9d. per therm, as compared with a flat rate of 12·5d. per therm in the borough.

They gave an excellent after sales service, coupled with a very easy hire purchase to enable customers to take the many advantages of a gas supply.

"I can assure the people of Chiseldon," said Major Wright, "that we are earnest in our endeavour to give a good service at an economical rate, and I would thank those members of the Parish Council who have not been able to attend, but have sent kind messages of good wishes, together with you gentlemen, for attending to-day."

Trade Marks Committee, 1933.

The Trade Marks Committee which was set up in January last under the chairmanship of the Right Hon. Viscount Goschen to consider and report whether any, and if so what, changes in the existing law and practice relating to trade marks are desirable, are continuing their meetings for the purpose of hearing evidence from interested persons and associations. Seven meetings of the Committee have taken place, and during the next few weeks evidence will be taken from representatives of the Trade Marks, Patents and Designs Federation, Ltd., the Trade Mark Owners Association, Ltd., and the Chartered Institute of Patent Agents.

Any persons or associations who desire to submit any further suggestions, or to give evidence, should notify their intention to the Secretary of the Committee, Mr. R. W. Luce, Industrial Property Department, Board of Trade, 25, Southampton Buildings, W.C. 2, not later than June 3 next.

Parkinson Football Club's Good Season.

The season just closed has been a very successful one for the Parkinson Stove Company's Football Club, which has achieved somewhat of a record in the Birmingham and District Works Amateur Football Association, by winning the Lord Howard de Walden Cup, the Charles Wade Victory Cup, and the Championship of Division 5, for which they are holders of the Evans Challenge Shield.

It is significant that in the last five football seasons they have won six Cups and three Shields, as well as being runners-up for League Championships on three occasions, a record of which they may well be proud.

The Parkinson Club runs two teams, the first winning eighteen out of their twenty-two matches and only losing two during the last season.

Protection of Iron and Steel from Rust and Corrosion.

[CONTRIBUTED.]

Rusting is a special case of corrosion depending upon the combined influences of moisture, oxygen, and carbon dioxide, the process being accelerated by the presence of acidic substances in the atmosphere. The rate of corrosion or rusting of an iron or steel surface depends upon the conditions to which it is subjected, and may vary very widely.

One of the best ways of protecting iron and steel from rust and corrosion is by a coating of zinc (spelter)—*i.e.*, galvanizing.

The term "galvanizing" is usually understood to apply to the "hot" galvanizing process, in which the articles to be treated are immersed in a bath of molten zinc, and is the process with which we are concerned here. This process is distinct from the electro-galvanic method, in which a thin coating of zinc is deposited by the action of an electric current.

Hot galvanizing is recommended wherever possible, because this process results, when correctly carried out, in the production of an even, substantial, and homogeneous coating which is corrosion-resisting, pliable, and firmly adherent to the iron and steel base.

The anti-corrosive action of galvanized coatings depends entirely on their weather resisting properties. When properly deposited, these coatings hermetically seal the

surface and completely prevent the access of air to the underlying iron or steel. The practice of coating iron with zinc has, therefore, nothing to do with the relative electrolytic properties of zinc and iron, but is based on the fact that zinc itself is a highly weatherproof metal. After a short exposure to the atmosphere, zinc becomes coated with an extremely dense and insoluble coating of zinc oxide and basic zinc carbonate, which itself protects the underlying zinc from further action of atmospheric agencies.

The zinc coating becomes alloyed with the surface of the iron, and this coating is composite in character and consists of several layers merging one into the other, so that there is no really sharp boundary between the iron surface underneath and the pure zinc above. The hot galvanizing process is therefore a most successful method of protecting iron and steel from corrosion, and is most economical.

B.C.G.A. Yorkshire District Conference.

A Yorkshire District Conference of the British Commercial Gas Association will be held in Halifax on Friday next, May 12. The morning session will take place in the Council Chamber of the Town Hall, when, at eleven o'clock the Mayor, Alderman W. Crabtree, will extend a civic welcome. This will be followed by an address by Sir Francis Goodenough, Executive Chairman of the B.C.G.A.

Alderman J. H. Waddington (Chairman of the Halifax Gas Committee) will preside at both morning and afternoon sessions. The afternoon session will be held at the Marlborough Hall, the speakers being Mr. E. Crowther, of Bradford, and Mr. C. R. Ingham, of Brighouse.

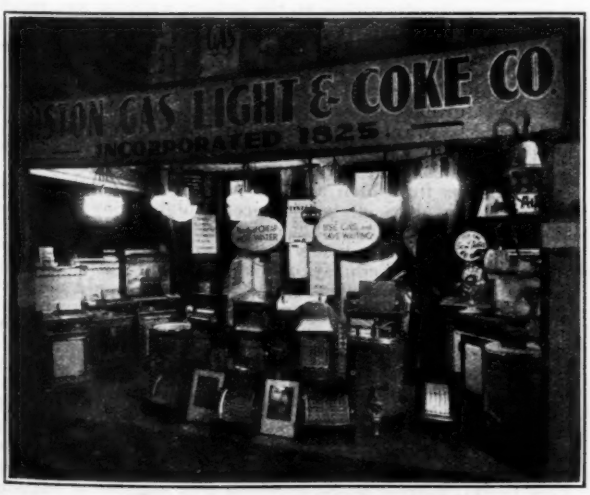
"A National Menace."

In the House of Commons on Tuesday of last week, when the resolution relating to the tax on imported fuel oils was submitted for approval, Mr. R. G. Clarry, Chairman of the British Road Tar Association, supported the tax because it had a tendency to support the coal industry, which was striving very hard. The growth of oil importations had been a national menace. Coal was the basis of all our industries, and if we allowed the inroads of imported foreign oil to continue we might get to a state when British industrial production was dependent on an oil pipeline over which we had no control.

Turning to the Gas Industry, the second largest user of oil fuel in the country, he said that even so they were not objecting to the tax, because they realized the future benefit that would accrue to coal. By virtue of its statutory obligations the Industry had to carry stocks which to-day amounted to about £100,000 worth, and the duty being retrospective the Industry would be penalized on account of its special obligations. He sincerely hoped the Minister would reconsider the position of these stocks and exempt them from the duty of 1d. a gallon.

Every 100 tons of fuel-oil imported into this country replaced 150 tons of British coal, and he hoped the tax which the Chancellor proposed was only a commencement towards the millennium which they hoped for, with an increase in coal production.

Gas Publicity at Boston.



A photograph of the Boston Gas Light and Coke Company's stand at a recent Trades Exhibition at Boston, Lincs.

THE NEWS—*continued.*

Suggested Lancashire Amalgamation Vetoed.

As mentioned in the "JOURNAL" for April 19 last, the appointment of Mr. J. Mitchell, the Nelson Gas Engineer, to the position of Gas Engineer to the City of Leicester furnished the opportunity for a proposal from Burnley that the Burnley and Nelson Gas Undertakings should be merged into one. A report on the subject was prepared by Mr. J. H. Clegg, the Burnley Gas Engineer, and submitted to the Nelson Gas Committee.

A report was also submitted by Mr. Mitchell, so that the Committee had full information on which to act when they discussed the question last Friday. The Committee turned the proposal down, and are proceeding with the appointment of a successor to Mr. Mitchell.

Gas Undertakings in Relation to Imperial and Local Taxation.

In present circumstances it is hardly necessary to stress the desirability that all assessments to income-tax and local rates shall be most carefully scrutinized, in order that no reliefs or other provisions favourable to the taxpayer may be overlooked. Not only is there doubt about an early reduction in income-tax, but any simplification which might be anticipated by the long-awaited codification of the Taxing Statutes is again deferred. As to local taxation, the Minister of Health emphasized the immensity of this burden when he stated that the product of a penny rate levied on all rateable properties in England and Wales (excluding property exempted under the "de-rating" scheme) is, for the past financial year, estimated at £1,055,574. Many readers will be familiar with our republication of Seymour's "Principles and Practice of the Assessment of Gas Undertakings for Imperial and Local Taxation," and this standard work of reference, which had an excellent reception from the Technical and Accountancy Press, can be thoroughly recommended to all officials of public utility undertakings who may be responsible for the negotiations relating to assessments. Opportunity may later be taken to refer to some provisions of the new Finance Act, and to indicate any minor amendments to Seymour's "Assessment of Gas Undertakings" which may be necessitated thereby.

A Tour of Coventry.

Gas Meters Filmed in the Making.

We appreciated the opportunity the other day of being present at a private view of a film tour of Coventry, showing some of the most interesting buildings, together with some of the most important industries whereby the "City of Three Spires" is waging war against the present depression. Among the industries filmed is that of gas meter manufacture as carried on at the Foleshill Road Works of Messrs. George Wilson Gas Meters, Ltd.

The film, which, we understand, is one of a series embracing some of the leading towns in the country and their industries, was produced by the National Progress Film Company, Ltd., of 60, Wardour Street, W. 1, in co-operation with the Coventry Development Committee, Messrs. Armstrong Siddeley Motors, Ltd., Messrs. George Wilson Gas Meters, Ltd., and Messrs. A. C. Wickman, Ltd., manufacturers of high-precision machine tools.

The scenes in the film are supported by an explanatory talk, clearly describing the various buildings and industries seen, and during the tour one has several excellent aerial views of the city.

In the course of the section devoted to Messrs. George Wilson's works one is given a clear insight into the many processes involved in the manufacture of their meters, each type of which has some three hundred component parts. From the manufacture of the outside cases one is taken through the various departments, where one sees in turn the fixing of the valve mechanism, the index dials, prepayment mechanism, and the diaphragm leathers, which are of high-grade material and treated with a special process for prolonging their life under the arduous duties they are called upon to perform. Finally, a peep is taken at the testing department where every meter produced is carefully tested to ensure that it registers with the utmost accuracy, for, as it is explained, the gas meter is the only household

THE NEWS—*continued.*

appliance which bears the Board of Trade official stamp of reliability.

This film as a whole is a good one in that it gets away from the " publicity reel " type by drawing a highly interesting picture of one of England's foremost cities, thereby making it a production which will be of universal interest wherever it is shown; and Messrs. George Wilson Gas Meters, Ltd., are to be congratulated in taking part in the film, which acknowledges them to be one of Coventry's leading industries.

Organizing for Leisure

The Guest of Honour at the Annual Dinner of the Chemical Engineering Group of the Society of Chemical Industry, held at the Waldorf Hotel, London, on April 28, was the Right Hon. Lord Melchett, who addressed those present on " Modern Economics and Unemployment."

Within the last century, he said, the development of science had been such that there were practically no products which we could not produce to-day in almost unlimited quantities, for all practical purposes, and the difficulty was not one of production but of distribution, and it was in the distribution of the primary commodities that we had entirely failed hitherto. The list of primary commodities numbered about 26, but there was one which we were producing to-day at an alarming rate and with amazing efficiency which never appeared on that list, but which in future years must be included in it—viz., leisure—and it was just as important to mankind as any of the others. We had been producing enormous quantities of leisure throughout the post-war period, and he preferred this name to unemployment, because that seemed to him a misnomer. The Chancellor of the Exchequer had recently stated in the House of Commons that unemployment on something like its present scale was likely to last for another ten years, but if he had said 100 years he would have been much nearer the mark. The reason for this was that from year to year we were finding more and more means of conducting industrial operations by mechanical methods with fewer and fewer men. More ways were being found for the individual man to increase his output to an alarming extent every day, and, as he had said on more than one occasion, he was convinced that science would put more men out of work than any Government would have the brains to put into work. Although that could be looked upon as a very serious and a very terrible thing, the fact was that we had reached a stage in human development where we were able to afford a very large amount of leisure to the masses of our population who, in the past, had not had the opportunity of enjoying any leisure at all, although we had not yet become used to conceiving that idea. This was, therefore an aspect of the labour question upon which he wished to dwell.

Regulating Leisure.

Continuing, Lord Melchett said that his own conception of this production of leisure brought about by the increased application of science to industry, and which could be expected to increase in the future, was that it could be used for the positive benefit of mankind. It was possible to regulate leisure within our own country in such a way as to obtain the maximum benefit from it, instead of, as was the case to-day, making it one of the greatest evils that ever afflicted the human race. It was a terrible thing to contemplate that we were bringing up a generation of young men and young women many of whom had never worked at all, who had never known what it was to have work, and who had never been subjected to the normal discipline of any sort of regular occupation, and, moreover, who had not had the opportunity of acquiring at an early age skill in any sort of trade. We were at the present time bringing up a generation of people who were accustoming themselves to a low standard of living based upon idleness and who, in consequence, were developing the idea at the back of their minds that there was no place for them in the world, that there was no necessity for their existence, and that they might just as well be dead for all the world cared. That was a terrible thing to contemplate. These people were being under-fed, they were not too well housed, and they were under-developed.

All this was tending to the breaking up of the national spirit of the national ideal which should be considered essential to the up-building of our national character. In these circumstances it was going to be hard to fit these people into industrial life as their fathers and grandfathers were brought into it, and, moreover, we had to realize that this problem was not getting easier, but more difficult.

He was told that during the year 1934 there would be 438,000 boys and girls of 14 leaving school and entering employment as compared with 292,000 in 1932. That increase would continue, and the peak would be reached in about 1937; therefore, a substantial improvement in industrial conditions was not going to solve this problem of the over-production of leisure. On the other hand, it was highly probable that between 1932 and 1937 methods would be devised—among others by some of those present that evening—which would have the effect of putting more people out of work than the increase in productive capacity would put into work.

Every employer of labour on a large scale to-day, continued Lord Melchett, is faced with the problem of deciding to perform his industrial operations with fewer men and greater efficiency, or to keep on the same number of men and perform the operations with less efficiency and less economy. The majority of industrial employers would prefer to remain incompetent rather than put these men out of work, but in the large organizations which existed to-day decisions had to be made on questions of high policy and with great heart searching, and those responsible for these large organizations had made up their minds that their first duty to their industry and to their country was to be as efficient as possible and to place on the nation as a whole the responsibility of solving this dreadful question of unemployment, or, as he himself preferred to call it, the over-production of leisure.

Pooling Employment and Leisure.

It was impossible to conceive employers in every industry deliberately allowing themselves to become inefficient, however humanitarian or however sympathetic their reasons might be. If such were the case, the result for the nation as a whole would be disastrous; therefore we were bound to assume that the result of this problem of increased efficiency was not a matter for the individual employer, and he himself had come to the conclusion that sooner or later we should have to organize the country in such a way as to shorten the hours worked, not, however, by shortening the number of hours per day or the number of days per week. What could be done was to pool a man's employment and leisure together in such a way that he would have, under an organized system, a month's, two months', or even three months' leisure allotted to him as a definite part of his employment. The man would be required to sign off for that period and then to sign on again under an organized system in which all workers would take part, but he should also be compelled to make profitable use of that period of leisure to improve his position intellectually and physically. At the present time the unemployed were wasting the leisure that was forced upon them, and were a great source of expense to the nation without any result whatsoever; but under an organized scheme such as he had suggested a very much larger number of people would be provided with work with a definite period of leisure which they would be compelled to make profitable use of. For instance, during the period of leisure, a subsistence rate of pay would be granted, but those who made the most profitable use of this period by improving their efficiency in the work in which they were engaged and in other ways—opportunities for which also, of course, would have to be on an organized basis—would receive higher payments and rewards. If some such policy as this were adopted he was convinced that in five years there would be a dramatic and real change in the educational and general outlook of the population of the country. Such a scheme would not cost any considerable sum of money as compared with the cost of unemployment to the country at the present time when 75% of the population were working with a fortnight's holiday each year, a most irrational system with so many unemployed. Undoubtedly there would be difficulties and obstacles, but he did not believe there were any which could not be overcome. There would have to be licensing and the exemption of certain key men from the general rule, but he believed that such a system was the only solution to this fearful problem which was capable of sapping the most vital qualities upon which the nation had depended in the past.

XUM

Institution of Gas Engineers' Examinations

The following questions were set in the Examinations in Gas Engineering and Gas Supply, which were held on April 29 and May 6 respectively, under the Education Scheme of the Institution of Gas Engineers

GAS ENGINEERING.

ORDINARY GRADE.

From 2 p.m. to 5 p.m.

(Candidates should attempt not more than two questions in each Group.)

Simple sketches, roughly to scale, should be made to obviate long and involved statements. Lucidity of expression and the general neatness of the paper and sketches, will be taken into consideration.

GROUP A.

1. Sketch and describe a cross-section of a retort setting with regenerative furnace.
2. Sketch a cross-section through a hydraulic main with anti-dip equipment, and explain how it is used.
3. Compare the composition, calorific values, and specific gravities of coal gas and carburetted water gas, assuming 1 gallon of oil to be used per 1000 c.ft. of carburetted water gas.

GROUP B.

4. Explain in general terms how the ammonia in crude coal gas is produced and removed.
   State the approximate quantity of ammonia produced per ton of coal carbonized in terms of ammoniacal liquor or ammonium sulphate.
5. Describe the material used for removing sulphuretted hydrogen from gas and sketch a cross-section through a purifier box, showing how the material is supported and the cover made gas tight.
6. Describe with sketches the construction of a station meter. If the gas registered at 55° F. temperature and 29·5 in. pressure is 1,000,000 c.ft., how much would the same gas register at 60° F. and 30 in. pressure?

GROUP C.

7. What is the difference between a pressure gauge and a pressure register?
   Sketch and describe the construction of one type of pressure register and explain how it works.
8. Sketch and describe one type of photometer and explain how it is used.
9. Sketch and describe the apparatus used for the Gas Referees' sulphur test and explain how it is used.

HIGHER GRADE.

PART I., from 2 p.m. to 5 p.m.

(Candidates should attempt not more than two questions in each Group.)

Sketches should be roughly to scale. Simple line drawings only are required, provided they are clear and indicate the principles involved

GROUP A.

1. (*a*) Describe the method of determining the calorific value of gas by means of a non-recording calorimeter. Give a sketch of the apparatus used.
   (*b*) Calculate the calorific value of a sample of gas having the following composition:

	%
Carbon dioxide	3·5
Unsaturated hydrocarbons	2·2
Oxygen	1·0
Carbon monoxide	10·0
Methane	26·4
Hydrogen	46·9
Nitrogen	10·0

2. Describe the conditions you consider necessary in a carburetted water gas plant in order to obtain the best results, stating:
   (*a*) The steam and blast pressures,
   (*b*) The cycle worked and the reason for its adoption,
   (*c*) The temperature of the superheater when using various quantities of oil, and
   (*d*) The regulating instruments you would expect to find on a modern carburetted water gas plant.
3. Describe the manufacture of neutral dry sulphate of ammonia from ammoniacal liquor. Give a sketch of the plant used. How many lbs. of sulphate would you expect to make per ton of coal carbonized?

GROUP B.

4. Sketch a waterless gasholder and explain its action. What precautions are necessary to ensure the safe working of the holder?
5. A retort house of horizontal or vertical retorts is required to produce approximately 5600 therms per diem:
   (*a*) Describe with the aid of sketches a retort house capable of performing this duty. Show the main features and give the principal dimensions.
   (*b*) Show how you would arrive at the number and size of the retorts required, giving any calculations you would make.
   (*c*) State the class of coal you would carbonize.
6. A coke screening plant is required to screen coke into grades (i) 0 in. to $\frac{3}{4}$ in.; (ii.) $\frac{3}{4}$ in. to $1\frac{1}{4}$ in.; (iii.) $1\frac{1}{4}$ in. to 2 in.; (iv.) over 2 in.
   (*a*) Sketch a plant suitable for performing this duty and describe its action.
   (*b*) Give the percentages of the above grades of coke you would expect to obtain after screening and state the approximate percentage of ash which would be found in each grade. Name the class of coal from which the coke is to be made and the type of plant in which the coal is to be carbonized.

HIGHER GRADE.

PART II., from 6 p.m. to 9 p.m.

(Candidates should attempt not more than two questions in each Group.)

Sketches should be roughly to scale. Simple line drawings only are required, provided they are clear and indicate the principles involved.

GROUP A.

1. Explain why it is necessary to test regularly the gas leaving a gas-works for distribution for:
   (*a*) Sulphuretted hydrogen,
   (*b*) Ammonia,
   (*c*) Calorific value, and
   (*d*) Specific gravity.
2. Describe with the aid of a sketch and explain the method of operating the Gray-King or other similar laboratory apparatus for testing coal.
   What information can be obtained by using the apparatus?
   Give an example of the typical results you would expect from any coal with which you are familiar. State the class of coal to which these results refer.
3. (*a*) Describe a method of working a series of oxide purifiers for the removal of sulphuretted hydrogen. Give the chemical equations representing the reactions which take place in the purifiers and during revivification of the oxide.
   (*b*) Explain how you would ascertain the percentage of sulphur in a sample of spent oxide.

GROUP B.

4. Sketch a retort house governor and describe its functions and method of working.
   What precautions are necessary to maintain the governor in efficient working order?
5. A condensing plant is required to cool the gas made in continuous vertical retorts. One million c.ft. of gas are made per diem having a calorific value of 480 B.Th.U. per c.ft. If approximately 82 therms are made per ton of coal carbonized:
   (*a*) What would you expect the temperature of the gas to be in the foul main and to what temperature would you cool it at the outlet of the condensers?
   (*b*) Sketch a plant suitable for cooling the gas to the temperature you decide is necessary, giving your reasons for adopting the type of plant selected. How would you determine the condensing area required?
6. Describe with the aid of a sketch how you would obtain an indicator diagram on a gas engine.
   Give a sketch showing a typical gas engine diagram and explain briefly the effect of the various strokes of the engine. How would you calculate the indicated horse power of the engine?

DIPLOMA EXAMINATION IN GAS ENGINEERING (Manufacture).

PART I., from 2 p.m. to 5 p.m.

(Candidates should attempt not more than four questions.)

1. You are asked to lay out a new works to produce 20,000 therms per diem of 500 B.Th.U. gas, on land adjoining a railway line:
   (*a*) Show, by means of diagrammatic sketches, your proposed lay-out.
   (*b*) Describe the type of gas manufacturing plant you would install.
   (*c*) Explain the method of coal and coke handling and other transport arrangements.
   (*d*) Discuss the method of operating the condensing and washing plant whereby ammonia may be recovered as liquor without the introduction of extraneous water.

(*c*) State the approximate capital cost of the new plant per million c.ft. of gas made and per ton of coal carbonized.

2. State briefly, in so far as they are applicable to the carrying on of a gas-works, the most important provisions of (*a*) The Factory and Workshop Acts, giving details of the principal features of the Chemical Works Regulations and of the Electricity Regulations, and (*b*) the Alkali Acts.

3. Compare the oil washing and active carbon methods for benzole extraction. Give figures to show if, in your opinion, benzole recovery on gas-works is or is not a commercial proposition.

4. What points would you emphasize particularly in drawing up (i.) a Specification for the construction of, and (ii.) an Inspection and Maintenance Schedule for, a large waterless gasholder?

5. Discuss the most important recent developments of general interest relating to Gas Engineering (Manufacture, Distribution, and Utilization) which have been described in the Technical Press.

PART II., from 6 p.m. to 9 p.m.

(*Candidates should attempt not more than four questions.*)

1. (*a*) Describe a method for computing the thermal yields from oil and coke in carburetted water gas manufacture, and illustrate by an example of good modern working.
(*b*) It has been suggested that a suitable outlet for coal tar, coal tar creosote, and low-temperature tar might be found by carburetting these products in a carburetted water gas plant. Discuss this, stating the carburetting efficiency and operating difficulties to be expected as to each product.

2. (*a*) Discuss the essential factors to be observed for the efficient control and administration of a gas undertaking.
(*b*) Give an example of a monthly analysis of works costs.
(*c*) State the basis of ascertainment of the costs in (*b*).

3. What particular features would you specify to meet gas-works conditions in (i.) electric generators, (ii.) electric motors, and (iii.) electric switchgear? State the kind of current favoured and give reasons.

4. (*a*) Discuss the theory and practice of coal blending in its relation to carbonizing results and coke yield, and give a suitable example.
(*b*) Describe, by means of sketches, a plant for the dry cleaning of coke, and state at which point of a coke cutting and grading plant you would install such plant.

5. (*a*) Outline the principles of gas dehydration by any establishment method. Illustrate with sketches a modern plant, give the approximate cost of the process, and indicate how the advantages from the use of dry gas may be expected to justify the cost.
(*b*) Should small quantities of ammonia be allowed to pass forward from the purifiers into the washer, what would be the effect upon the calcium chloride solution? What would be the result if this were allowed to take place over a long period, and explain the method you would adopt to revivify the calcium chloride solution.

GAS SUPPLY.

ORDINARY GRADE.

From 2 p.m. to 5 p.m.

(*Candidates should attempt not more than two questions in each Group, of which Question 9 must be one in Group C.*)

Simple sketches, roughly to scale, should be made to obviate long and involved statements. Lucidity of expression and the general neatness of the paper and sketches, will be taken into consideration.

GROUP A.

1. Give a typical analysis of town gas and calculate the volume of CO_2 produced from the combustion of one cubic foot of the gas. Why is it important to ensure the complete combustion of the gas?

2. A new estate is to be developed 3000 yards from and at the same level as the nearest gas supply. What size of main would be required for a maximum demand of 50,000 c.ft. per hour, assuming an allowable pressure drop of 2 in. and a specific gravity of 0·5? (Pole's Formula is $V = 1350\sqrt{\frac{pd^5}{st}}$.)

3. State the causes of variations of gas pressure in a district main and describe the methods employed for minimizing the effect of these variations.

GROUP B.

4. How would you state the case for gas lighting compared with electric lighting, for use in (*a*) factories and (*b*) small houses.

5. Describe in their proper order the operations necessary to exchange a by-passed factory meter without interrupting the consumers' supply or admitting air to the outlet pipes.

6. Give your recommendations for a gas fired water heating installation for supplying a lavatory having 25 basins (2 gallons each) in use daily at 12 noon, 5 p.m., and 7 p.m.

Assuming the following data, what would be the approximate cost per day for gas to supply the required hot water:

Average temperature of hot water	105° F.
,, ,, ,, cold ,,	40° ,,
Thermal efficiency of apparatus	70%
Price of gas, per therm	8d.

GROUP C.

7. Make a sketch of a baffler and explain fully why it is fitted *inside* the room containing the appliance.

8. Make a sectional sketch of a gas cooker thermostat and show particularly how the different temperatures are maintained. What would be the effect of variable gas pressure upon the working of the thermostat?

9. Sketch and describe *any two* of the following and state the hourly gas consumption required:
(*a*) Gas heated soldering iron stove.
(*b*) Self heated gas soldering iron.
(*c*) Gas heated laundry iron.
(*d*) Gas blowpipe.

HIGHER GRADE.

PART I., from 2 p.m. to 5 p.m.

(*Candidates should attempt not more than two questions in Group A and three questions in Group B.*)

Sketches should be roughly to scale. Simple line drawings only are required, provided they are clear and indicate the principles involved.

GROUP A.

1. (*a*) The volume of gas in a holder is reduced in 12 hours from four million c.ft. to half-a-million c.ft., no gas having been added. The following conditions were observed:

	At Beginning.	At End.
Barometric pressure	29·5	30·5
Temperature of gas in holder	50° F.	55° F.
Pressure thrown by holder, in inches	8	4

Calculate the volume (corrected to 60° F. and 30 in. pressure *wet*) of gas removed from the holder, using the following:

Tensions of aqueous vapour at 60° F.—0·517 in. mercury
,, ,, ,, 55° F.—0·432 in. ,,
,, ,, ,, 50° F.—0·360 in. ,,

(*b*) Why is the tension of aqueous vapour taken into account?

2. (*a*) State what you know of the mechanical stresses and corrosive actions to which pipes in the ground are liable. With this in view, what are the relative merits of cast iron and steel for pipes?
(*b*) State your opinion of, and give your reasons for using, (i.) turned and bored joints and (ii.) half turned and bored joints.

3. Two points A and B five miles apart are joined by a pipe of uniform diameter. There are no connections to the pipe *en route*. Gas is flowing from A (at datum level) to B (100 ft. above datum level) and the distribution of pressure along the pipe is as follows:

Miles from A.	Pressure W.G.
At A	4·0
1 mile from A	3·8
2 miles ,,	3·6
3 ,, ,,	3·2
4 ,, ,,	3·4
At B—5 ,, ,,	3·0

Plot this relationship between pressure and distance, and calculate the height of the pipe at a point 3 miles from A. The specific gravity of the gas is 0·55 and water may be taken as 800 times as heavy as air.

GROUP B.

4. A sample of flue gases in a chimney leading from a gas fire is found to contain 0·3% (by volume) of CO_2. If the fire consumes 35 c.ft. per hour, how much air is being drawn from the room into the chimney? You may assume, but should state in your answer, a constitution for the unconsumed gas.

5. If you were asked to arrange a survey of the meters in use on a district, what instructions would you give to ensure that the information obtained showed the conditions as regards accuracy, soundness, adequacy of size, and general working of the meters?

6. What are the respective purposes of station, district, service, and appliance governors? Sketch an appliance governor, explain its theory, and state in what circumstances you would recommend that it be used in preference to a service governor, giving your reasons.

7. A workshop having a floor area of 100 ft. by 50 ft. is to have an average horizontal illumination of 4 foot-candles 3 ft. above floor level.
(*a*) What size, type, and number of low-pressure lamps would you recommend, and what height and spacing would you allow?
(*b*) Sketch a lamp shade that would meet workshop requirements and draw its approximate polar curve.

PART II., from 6 p.m. to 9 p.m.

(Candidates should attempt not more than two questions in Group A and three questions in Group B, of which Question 7 (a) or (b) must be done.)

Sketches should be roughly to scale. Simple line drawings only are required, provided they are clear and indicate the principles involved.

GROUP A.

1. (*a*) Discuss the relative merits of gas and coke for providing domestic hot water. State the conditions favourable to each.
   (*b*) Sketch in outline an installation for combining gas and coke for central heating, showing its more important features. In what circumstances would you recommend a calorifier?
2. Describe with sketches a gas operated refrigerator and state its advantages and disadvantages in comparison with a refrigerator of the mechanical type.
3. Describe in detail, with sketches, a method of space heating by gas fired air heating apparatus.

GROUP B.

4. Calculate the cost per therm of gas, coke, oil, and electricity, assuming gas (500 C.V.) to cost 3s. per 1000 c.ft., coke 35s. per ton, oil 65s. per ton, and electricity 1d. per unit.
   When used for hot water supply, how are the working results and running costs of these agencies affected by thermostatic control, variations in demand, and "stand-by" losses?
5. What do you understand by "complete combustion?" What degree of "complete combustion" is reached in (*a*) gas fires, and (*b*) flueless heaters? What important conditions in these appliances are necessary to ensure good combustion?
6. (*a*) Explain the Otto cycle and, by means of indicator diagrams, show how the following defects in a gas engine are revealed:
   (*a*) Blocked exhaust pipe.
   (*b*) Premature ignition.
   (*b*) Sketch a good indicator diagram for a gas engine.
7. (*a*) A consumer requires a furnace for hardening high speed steel lathe tools, having a section of approximately $\frac{3}{4}$ in. square. What type and size of furnace would you recommend, and what temperature would be required? Briefly describe the process of hardening the tools.

   Or

   (*b*) Explain briefly the following terms used in industrial gas-heating practice:
   (i.) Thermal capacity.
   (ii.) Specific heat.
   (iii.) Oxidation.
   (iv.) Reducing atmosphere.
   (v.) Surface combustion.
   (vi.) Gas and air incorporator.

DIPLOMA EXAMINATION IN GAS ENGINEERING (Supply).

PART I., from 2 p.m. to 5 p.m.

(Candidates should attempt not more than three questions.)

1. (*a*) Given the volume of gas to be passed through a main and the pressure drop to be allowed between the ends, show, from first principles, how to calculate the horse-power required to transport the gas.
   (*b*) For the same main and the same volume of gas how will the pressure drop and the required horse-power be effected by a change in the specific gravity of the gas?
   (*c*) What do you consider would be the ratio between the horse-power required to transport the gas and the horse-power of a gas engine capable of doing the work? Give reasons.
2. By means of diagrams and chemical equations, explain how electrolysis occurs. How would you make a survey of a network of mains to ascertain if there was risk of electrolysis? What steps would you take if you found evidence of the risk?
3. Explain why the ratio CO/CO_2 can never be zero in practice. Give some typical CO/CO_2 ratios for gas consuming appliances. State briefly how the ratio is ascertained and the conditions that influence its value.
4. (*a*) Calculate the weight of water produced from the combustion of one cubic foot of gas of an assumed composition.
   (*b*) Why is it that in two appliances having the same flue heat, the water of combustion appears in the appliance as a liquid in one case and not in the other, although the flue heat is sufficient to keep all the water of combustion in a state of vapour? (Density of hydrogen 5·89 lbs. per 1000 c.ft.)

PART II., from 6 p.m. to 9 p.m.

(Candidates should attempt not more than three questions.)

1. (*a*) By means of sketches and polar diagrams, explain the advantages and disadvantages of the light-directing devices used in modern street lighting.
   (*b*) What are isolux and iso-candle diagrams, and how can they be used in designing street lighting installations? Give examples.
2. A consumer (who is a physicist) requires to know:
   (i.) Why gas fire radiants are sometimes inclined and sometimes vertical.
   (ii.) The properties of the radiation from a modern gas fire that account for its therapeutical value.
   (iii.) If a gas fire, 14 in. wide, differs in radiant efficiency from a similar gas fire only 10 in. wide.

   What answers would you give?
3. (*a*) Make a sketch of a gas fired air heater for space heating, and mention the accessories for ensuring comfort, reliability, and safety.
   (*b*) What is meant by air conditioning, and how is it effected?
   (*c*) What precautions would you take to ensure that air heated to 300° F. for central heating lost nothing of its hygienic value?
4. Write short notes on some aspects of:
   (*a*) Reynold's Criterion.
   (*b*) Dehydration of gas.
   (*c*) Economy flues.
   (*d*) Gas *versus* electricity for street lighting.

CONTINENTAL NOTES

ATTEMPTS TO REDUCE THE SELF-IGNITION TEMPERATURE OF TAR OILS.

R. Hartner-Seberich and O. Horn, in *Brennstoff-Chemie*, 1933, 14, 141-147 (April 15), refer to the drawbacks of tar oils in high-speed internal combustion engines due to their high self-ignition temperature, and report the results of their investigation on the reduction of the self-ignition temperature by the addition of pro-knock materials.

Self-ignition temperatures were determined at atmospheric pressure by the dynamic crucible method, and under pressure in a bomb apparatus. A series of 40 substances representing a number of different classes of compounds was examined with a view to the selection of those having relatively low ignition temperatures for addition to tar oil. It was found that aldehydes, vegetable oils, nitro-compounds, iron pentacarbonyl, and amyl nitrite were the most promising. Tests were then carried out on mixtures of these compounds with a tar oil.

The most effective compound in reducing the self-ignition temperature of tar oil was found to be iron pentacarbonyl. This is specially interesting in view of the fact that the compound acts as an anti-knock agent when added to a liquid fuel in very low concentration, whereas it has the opposite effect when present in much larger concentration.

MERCAPTANS AS RESIN FORMERS IN MOTOR BENZOLE.

According to O. Kruber and W. Schade, *Brennstoff-Chemie*, 1933, 14, 124-128 (April 1), mercaptans play an important part in the resinification of motor benzole.

Di-enes such as *cyclo* pentadiene are not by themselves the chief factors, since, although a stable benzole to which this compound is added may forthwith show a high gum residue, the value progressively falls during storage, for the compound becomes converted into its dimeride which behaves as a volatile substance in the gum test. Really non-volatile resins are formed by reaction with mercaptans which must thus be regarded as catalysts of resinification.

Addition of 0·001% to 0·05% of ethyl mercaptan to refined motor benzole greatly increases the gum residue. With prolonged storage periods, the smaller additions were more effective than the larger additions, though the reverse was the case with short storage periods.

When refining is carried out without an alkali treatment, the benzole is liable to contain mercaptans and the use of alkali is essential if stability is required.

NEW METHODS FOR FIRE EXTINCTION.

The use of liquid carbon dioxide in cylinders as a means of fire extinction is described in *Brennstoff-Chemie*, 1933, 14, 135-6 (April 1), and illustrations of its application are reproduced. Portable or built-in equipment may be employed, and in the latter case provision for automatic functioning in the event of an outbreak may be made. The system, which is stated to be very rapid and effective, is applicable, for example, to the protection of storage tanks containing inflammable liquids.

XUM

MODERN SELLING . . POLICY . .

Mr. W. B. McLusky Addresses Midland Juniors

There was a good attendance of members of the Midland Junior Gas Association at the annual general meeting on Thursday, May 4, in the Reading Room of the Gas Department, Council House, Birmingham. Mr. F. A. C. PYKETT presided.

Four new members were elected; the annual report and statement of accounts were approved; and Mr. F. L. Atkin, of the Industrial Research Laboratory, Birmingham, was elected Junior Vice-President on the recommendation of the Council. Mr. S. K. Hawthorne, Senior Vice-President (Saltley Gas-Works) becomes President, and Mr. J. H. Wainwright (Halesowen) Senior Vice-President. In accordance with the Rules of the Association Messrs. H. S. Adams (Bilston) and J. H. Duignan (Kidderminster) retired from the Council, and they were thanked for their services; and Messrs. A. W. Attwood (Coventry) and W. T. Hobson (Wolverhampton) were elected to the vacancies, with the addition of Mr. H. C. Wills as a Birmingham member to the vacancy created by the promotion of Mr. Atkin to the Junior Vice-Presidency. The latter, who has been Hon. Secretary for five years, retired, and on the motion of Mr. W. L. S. SPINKS (Birmingham), seconded by Mr. HAWTHORNE, a hearty vote of thanks was passed to him for his services.

The members also paid their acknowledgments to Mr. F. A. Grant (Assistant Hon. Secretary), Mr. Geo. W. Smith (Hon. Treasurer), and Mr. W. P. Timbrell (Hon. Auditor).

Mr. A. Hill (Council House, Birmingham) was unanimously re-elected Hon. Secretary.

Messrs. H. R. Hems, W. Macnaughton, R. G. Marsh, and W. L. Spinks were thanked for their services as representatives on the Midland District Education Committee, and re-elected, and reference was also made to the good work of Mr. W. J. Pickering as the representative of the Joint Council of the Junior Gas Association, on the Executive Committee of the General Education Committee.

Mr. HEMS, replying to the vote, pointed out that the work on the Education Committee was becoming more or less routine, because the Education Scheme was now functioning as it was intended to function. Though the Committee's work had become considerably lighter, he desired to impress upon all members, and particularly the juniors, that the Committee wished to offer all the assistance they could to potential students. New regulations which would shortly be published would affect some of the higher-grade students. The standard of education in the Industry had been raised, and he was glad to say that the men who were coming forward were of the right class. The Junior Associations could feel proud of their work in connection with the Education Scheme.

ADDRESS

By Mr. W. B. McLUSKY, General Manager and Secretary of the Halifax Corporation Gas Department.

In these hard times it is a fine thing to have a job of work and an assured income: let us be thankful. To be permitted to make a living out of gas-making and a hobby out of selling gas are privileges—privileges which stern competition will curtail if we do not exercise our hobby with energy and intelligence.

We must have efficiency in production, but our work does not end there. An increase of 1000 c.ft. in the yield of gas per ton of coal carbonized may represent a saving equal to 3d. or more per ton of coal; but if we can find a customer for the increased production the revenue will benefit to the extent of perhaps 3s. or *more* per ton of coal carbonized.

It is axiomatic that profits are made from savings, not from earnings, but in my experience the finest way to meet the shortage of money caused through unemployment is to improve the service, to make gas more economical in use. This cannot be done without spending, but spending of this kind is a very good investment.

Another good investment for money is wages—wages paid to intelligent meter inspectors, smart salesmen, skilled craftsmen, and persistent maintenance men.

It is a remarkable state of affairs that money is out of work and men are out of work, and if we can discover any means of finding employment for both we shall improve our business for the present and strengthen our resources for the future. We are getting a better return for wages to-day. Our men are better equipped and our apprentices get quicker off the mark than formerly. That is the result of the higher standard of education.

The Halifax Gas Committee have adopted the Birmingham plan. They send their apprentices to the Day School two afternoons a week—there is a special form for these apprentices—they get their technical training in the Technical Colleges in the evenings.

The spirit of salesmanship seems to be getting hold not only of the apprentices but of men of long experience, and much of our new business can be attributed to the enthusiasm not only of the salesmen set apart for this work, but of the outdoor staff generally. This may explain to some extent why it is that, despite depression in trade, the sale of new appliances is well maintained. The travelling salesmen alone are bringing in orders for new business to the value of £100 per month per man employed.

In comparable towns in the West Riding and in Lancashire there are better and worse results than these.

In one case a progressive drop of 2s. 6d. per customer per annum over a period of three years; in another a progressive increase in the sale of gas in spite of acute depression in the staple trade of the town and sales growing at the rate of £2500 per annum per salesman employed—salesmen selling £25,000 worth of appliances in one year, which is equal in this case to 4s. per inhabitant per annum.

If sales are not well maintained we must not look about for excuses. What is the reason, for example, that the sale of gas per customer supplied and per inhabitant is so high in Birmingham? Because of the industrial load, you might say! But, no, that is not the only reason. Birmingham stripped of its tremendous industrial sales has an average consumption per customer supplied of 43,000 c.ft. Coventry stripped of its industrial load—representing 40% of the business done—has a sale of 31,000 c.ft. per customer supplied.

The average consumption of gas in this country during the year ended Dec. 31, 1931, for companies and March 31, 1932, for municipalities was 33,000 c.ft. Fifteen years earlier it was 29,000 c.ft.

We are told that "A variety of interests makes us more efficient." It is evident that neither Birmingham nor Coventry has allowed success in the industrial field to limit activities in other directions. Among their many activities the lighting business has been kept well to the front—where it ought to be. Private lighting and public lighting by gas are prominent in these cities.

In Yorkshire, too—especially in the industrial areas—gas for lighting is fostered to the mutual advantage of the customer and the undertaking. In one West Yorkshire town of 100,000 inhabitants there are 20,000 users of gas for lighting.

The lighting season is the cold season. A three-light incandescent fitting distributes over 4000 B.Th.U. per hour at a cost of less than ½d. per hour, and lights the room—free.

Taking a West Yorkshire town again, public lighting represents 9% of the total sales of gas and costs only 2s. per inhabitant per annum—for gas alone—equal to a rate of 5d. in the £. This is a good example of the value of sale by contract—a commodity charge of 6d. per therm for the volume of gas used up to 11 p.m. and 3½d. per therm for all-night lighting *plus* a fixed charge per lamp-standard. This system has satisfied buyer and seller for over ten years, and the business is increasing—an additional mantle adds but little to the bill.

BURNING "OVERHEADS."

We should use the gas meter where necessary; but only for its legitimate work, the measurement of gas, not fixed charges for overheads. These are not registered by the gas meter. One thousand c.ft. of gas may cost 3d. to produce—within reasonable limits any cost beyond that figure will have to be met whether we sell an extra 1000 c.ft. or not—but if a customer by accident or design uses an extra 1000 c.ft. of gas, why should we charge him up with another bunch of fixed charges? We cannot hope to develop our

business on these lines. The consumer does not burn "overheads." Why not be simple, and use the meter for the registration of the commodity and make a separate and agreed quarterly charge for the other things?

The average consumption of gas per customer supplied in this country is very low—not more than 3¾ c.ft. per customer per hour. That is to say, if every customer on our books had one lighting fitting *and nothing else*, and allowed that lighting fitting to remain in full use throughout the 8760 hours in a year, the present average hourly consumption of 33,000 c.ft. of gas per customer per annum would be maintained. Are we content with this small amount of business? If not, what are we going to do?

The most hopeful prospect of new business and the least costly—for the pipes are laid—is the present user of gas, our old customer. Of course, we are getting new ones too, and useful ones, but the old ones—those with whom we are best acquainted—seem to take more interest in improvements.

There is no luxury business for us. Gas is a public utility. It is made for work, and its value is judged not by what it looks like, but by what it will do. Price and performance are the first considerations.

Sales by Contract.

Sales by contract are more satisfactory than any other means of selling gas, because the customer knows the end from the beginning. He knows what he is to pay before he starts, and this is a big point. Where the control of the tap is not in the hands of the consumer himself the thermostat and the contract are good sellers of gas. This has been exemplified particularly in the conditioning of paper for the printing trade and in the heating of places of public entertainment; in the supply of gas to bakers' ovens, and for the heating of residences small and large. Some of the smaller central heating installations in residences represent a consumption of 40,000 c.ft. of gas per month in the winter time—nearly 250,000 c.ft. for the winter half-year. The schedule provides a much lower price for the summer half-year. Hot water is another good contract project—not only for storage heating, but for the instantaneous heating of small quantities of water.

Scale (1) which I have put before you has been specially prepared for domestic and industrial water heating, central heating, and for industrial units where the two-part tariff would be of no advantage to the customer.

The two-part tariff is of especial value where the business is concentrated and where the units are used regularly and not intermittently. The two-part tariff has steadily increased the industrial demand for gas in Halifax, the industrial load is now 18% of the total output.

The two-part tariff has been of great benefit to domestic users; it has brought the smallest consumer within the range of low all-in prices.

A fixed charge of 6d. per week and gas at 2s. per 1000 c.ft. gives the customer 1000 c.ft. a week for half-a-crown, and many occupants of the smaller houses use 1000 c.ft. of gas and more per week. In many of the larger houses the consumption exceeds 2000 c.ft. per week, and in exceptional cases we have consumptions of from 200,000 to 800,000 c.ft. per annum.

In the larger houses gas is appreciated chiefly, I think, for its reliability, and it is remarkable that in no case where the two-part tariff has been in operation, whether for industrial, commercial, or domestic purposes, do we find a customer disappointed with the amount of the quarterly account.

Coal is the basis of our business, and it is the cheapest element in our costs schedule. Why should we restrict its use? The commodity—gas—which we produce mainly from coal is the cheapest element of any moment in the rate-structure. Why should we keep it in the gasholders?

(1) Rates and taxes cost *more* than coal (less residuals).
(2) Carbonizing wages cost *less* than local rates.
(3) The repair and maintenance works costs no more than general administration, inspection, and collection.
(4) The wages bill for manufacture and distribution, apart from stoves and fittings, amounts to *less* than the annual charges for interest and sinking fund.

Finally, the figure representing the cost of the commodity we have to sell—namely, gas—is so small that we have almost lost sight of it.

There must be very few gas undertakings in the country that need charge more than 3½d. per therm for gas—*plus* an equitable fixed charge. At this figure our present users would use gas in increasing quantities and for a larger variety of purposes.

Vote of Thanks.

Mr. H. R. Hems, in proposing a vote of thanks, said it had been his privilege to work very closely with Mr. McLusky during the last few years in the development of the industrial load at Halifax. He had given the members much information in a short space, which was typical. Mr. McLusky had a definite ideal in front of him. He wanted to see gas sold at such a price and in such a way that it made it possible for a large percentage of his consumers to have all-gas houses. He agreed with the need for looking after existing consumers.

The vote of thanks was seconded by Mr. W. M. Macnaughton (Wolverhampton).

Mr. McLusky, in reply, said he looked upon it as a privilege to come to Birmingham to address a Junior Association. He had always been keenly interested in the work of the Junior Associations. He was a strong advocate of the two-part tariff, the adoption of which, in his experience, had always resulted in an increased sale of gas.

Replying to a question as to how the two-part tariff was applied to slot consumers, he said that they were on the same basis as other consumers. In his opinion, it was a disadvantage to set a slot meter to give a very small quantity of gas in order to get money to pay for rentals. He thought it much better to charge a fixed weekly rental and give more gas per penny.

Carbon Monoxide Detector.

A new and simple apparatus for the detection of carbon monoxide has been brought to our notice by Messrs. Wallach Bros., Ltd., 49, Tabernacle Street, London, E.C. 2. This device (known as the "Evertrusty-Degea") uses a mixture of iodine pentoxide and fuming sulphuric acid as indicator. On coming into contact with this mixture, carbon monoxide liberates iodine, which, according to its volume, changes a white carrier substance to various shades of blue-green.

The appliance consists of a nickel-plated cylindrical body containing a layer of activated charcoal for keeping back gases which may interfere with the measurement. It also contains a test tube filled with a white substance and a comparison tube, and has at one end a compressible rubber ball for forcing the air through the test tube.

For making tests in inaccessible places a 10 ft. extension tube is employed, which is fixed to the nozzle of the rubber ball. This enables tests to be taken in trenches, cellars, &c. The hose is wound on a metal reel fitting into the lid of the container.

The comparison tube is filled with three layers of finely granulated material of three shades of green, each denoting a different concentration of carbon monoxide, and is marked with a scale showing this clearly.

The whole apparatus, together with a supply of necessary refills, fits into a metal container for easy transport, and is secured to prevent damage.

Automatic Gas Water Heating.

The ever-increasing demand for economy in domestic labour, coupled with the convenience and utility of maintaining a supply of hot water constantly throughout the house, places the lagged gas-heated hot water supply apparatus in the forefront of heating systems now in vogue.

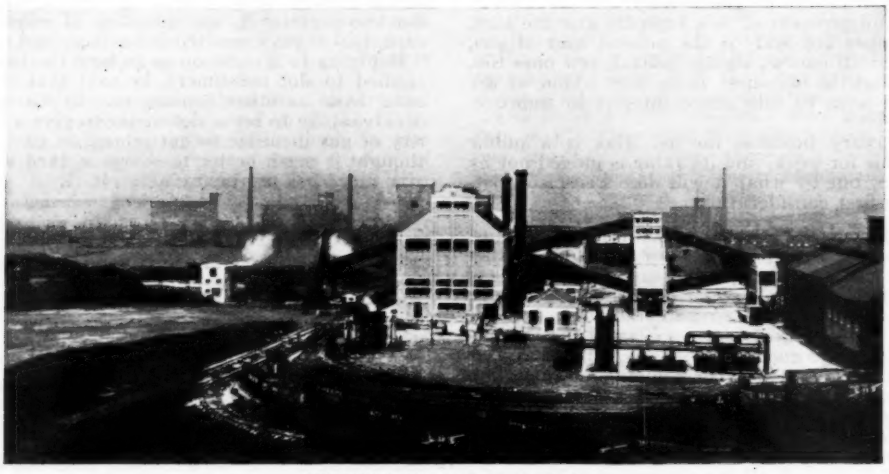
A catalogue recently issued by Messrs. Thomas Potterton (Heating Engineers), Ltd., of Cavendish Works, Balham, S.W. 12, covers a wide range of hot water apparatus required by the architect, builder, or householder in equipping the home or factory with efficient gas-heated hot water appliances, whether an entirely new installation—for which an enamelled thermal storage set of the most up-to-date kind is available—or a re-modelled system wherein circulating boilers are used, these being attached either singly or in batteries according to the demand.

The firm's "Empire" and "Emperor" boilers are two standardized appliances dealt with in the list, these being for attachment as heating units to cylindrical or rectangular hot water storage vessels, providing flexibility of adjustment for the purpose of operating towel rails, airing coils, &c. The boilers are fitted with bi-metal thermostat and luminous burners; they are capable of regulation to a by-pass consumption of 2 c.ft. per hour for the maintenance of heat in a lagged set. The "Emperor" boiler is enclosed in an insulated steel jacket, and finished externally in cellulose enamel and chromium plating.

The "Empire" and "Emperor" boilers are made in two sizes—No. 1 having a maximum output of 28 gallons of water per hour, 80° rise; and No. 2, 37 gallons per hour. The catalogue gives full specifications, details, and illustrations of the appliances and their accessories, together with particulars of the firm's "Victor" and "Rex" boilers, while a section at the end is devoted to instructions for fixing the apparatus—an interesting diagram showing the component parts of a combined coke and gas fired hot water installation, with the correct formation of the auxiliary circulations.

Reconstructed Gas-Works at Oldham

Inauguration by H.R.H. Prince George



HIGGINSHAW WORKS TO-DAY.

The reconstruction of the Higginshaw Gas-Works forms the first stage of the Oldham Gas Committee's policy of centralizing the production at this works, and the inauguration of the reconstructed works by Prince George on Monday last marks an epoch in the progress of the Undertaking.

The manufacture of gas in Oldham was commenced in 1827 under Parliamentary powers granted to the Oldham Gas Light and Waterworks Company in 1825. The advantages of the supply of gas were quickly realized, and a comparison between the first works of 1827, built on a portion of the site now occupied by the Central Gas-Works in Greaves Street, and the Gas Undertaking of to-day, is a striking example of progress. The first Gas Engineer for Oldham was Mr. George Emmott, who joined the Company in 1827. This gentleman was the grandfather of the late Lord Emmott, Member of Parliament for Oldham 1899-1911, when he was created a peer.

The old Company was acquired by the Corporation in 1853. All the shares of the old Company were converted into annuities at the rate of £1 per share, and, as there were 10,000 shares, the charges incurred by the Corporation were £10,000 per annum.

The gas-works in operation at the time of the acquisition were Oldham, Lees Brook, Shaw, Royton, and Hollinwood, the amount of gas made in the first year after the acquisition being 106 million c.ft., and the number of consumers 2170. The Lees Brook Works was dismantled in 1861, the Shaw Works in 1871, and the Royton Works in 1907.

The Gas Undertaking of Oldham to-day supplies an area of 16,128 acres (11,438 of which are outside the Municipal Borough) and has an output of 1,662,832,000 c.ft., delivered through 282 miles of mains to a population of 248,000. The coal carbonized last year was 97,098 tons and the make per ton was 17,108 c.ft. Compared with 2170 in 1853, the number of consumers last year was 58,093.

Since the acquisition of the works by the Corporation no less than £722,740 has been paid to the relief of rates in one way or another. The excess of assets over liabilities on March 31, 1932, was £846,944. The total revenue of the Undertaking for the year ended June 25, 1827, amounted to £2128. For the year ended March 31, 1932, the revenue amounted to £317,570.

The three manufacturing stations retained to supply the town and district are:

Central Works.

These works date from 1827, and have, of course, been several times reconstructed. The works are now connected with the L.M. and S. Railway and equipped with coal handling machinery. The carbonizing plant is an installation of Dempster-Toogood continuous vertical retorts built in 1914, and has a productive capacity of one million c.ft. per day, and the usual subsidiary plant is installed. There are two gasholders, having a combined storage of 980,000 c.ft.

Hollinwood Works.

These works are situated on the banks of the Manchester and Ashton-under-Lyne Canal, but have no railway connection. The early coal gas plant was on the easterly side of the Canal, but is now dismantled. The existing works, which are situated on the west side of the Canal, were first brought into use in 1873. Coal is carted into the works from the Railway coal yard on the other side of Manchester Road, and is then mechanically handled to the carbonizing plant. The carbonizing plant is an installation of Glover-West continuous vertical retorts, built in 1913, and has a productive capacity of 3 million c.ft. per day. It is equipped with coal and coke handling machinery, an overhead steam driven crane serving the coke to the screening plant and elevated hoppers, or to the storage yard. The carburetted water gas plant on the easterly side of the Canal was put into operation in 1902, and had a capacity of 1 million c.ft. per day. New generators and blowing plant were installed in 1929 and the capacity of the plant was increased to 1½ million c.ft. per day. The works are equipped with the usual subsidiary plant and there are five gasholders having a combined storage of 7,300,000 c.ft.

Higginshaw Works.

Opened in 1871, these works have extensive sidings in connection with the L.M. and S. Railway with standing room for 120 wagons, the traffic on these sidings being dealt with by two locomotives belonging to the Department.

Prior to the 1931-33 reconstruction scheme, the carbonizing plant consisted of 152 horizontal retorts in settings of eight, and heated on the regenerative system, the retorts being charged and discharged by machinery operated by compressed air motors. The productive capacity of this Station was 2¾ million c.ft. per day, and the plant was put into operation in 1902. From the wagons the coal was mechanically handled by bucket elevators and band conveyors into the adjoining coal store, and then again by bucket elevators into the overhead hoppers in the retort house to feed the travelling hopper on the charging machine. The hot coke was conveyed by drag bar conveyors to overhead hoppers in the yard, and thence by crane to screens and overhead storage hoppers.

The whole of the plant, together with the exhausters, condensers and washing plant, was kept in operation until the new plant had been started up, but has now been dismantled and sold.

The overhead crane gantry serving the coke storage ground, together with the oxide purifiers and the gasholders, four in number, with a combined storage of

2,400,000 c.ft., has been retained in the reconstructed works.

Reconstruction Scheme at Higginshaw Works.

In 1927, the present Gas Engineer, Mr. F. Greenhalgh, was appointed, and subsequently, at the request of the Gas-Works Committee, reported on the condition of the plant at the Higginshaw Works, and on the subject of centralizing the manufacture of gas at one works.

At that date the margin of gas-making plant over the maximum day's output of the previous year was only 6%—a precarious position, but for the relief afforded by the large gasholder storage. This matter was, however, made even more serious on account of the condition of the carbonizing plant at Higginshaw, which was such that its replacement demanded early consideration. These works were also, from a present-day standpoint, badly laid out for economical working, and the power for the operation of the works was supplied by numerous gas and steam engines scattered about the works wherever a power unit was required—the steam being supplied from two boiler houses at opposite ends of the works.

The site of the works is centrally situated in the area of supply and is some 33 acres in extent and, although filled-in ground, was, if cleared of the existing plant and buildings, capable of being developed as the centralized works for the supply of gas throughout the district.

The Central Works and Hollinwood Works, although at that date equipped with more modern plant, were both impracticable from the point of view of centralization. The Central Works are in the centre of the business portion of the town and the site is not nearly big enough for the purpose. The Hollinwood Works are practically at the extreme end of the supply area, and the site, while adequate at the moment, is not sufficiently large for any considerable extensions in the future. This site was, however, out of the question on account of its lack of railway communication—the railway being some 900 yards distant across the main Manchester Road.

The reports above mentioned received extended consideration by the Gas Committee, and, following an inspection by the Town Council, the works now completed received the Council's sanction on April 2, 1930, and received the sanction of the Ministry of Health and the Unemployment Grants Committee on Aug. 22, 1930.

THE RECONSTRUCTED WORKS.

The reconstructed Higginshaw Works have been designed by Mr. Greenhalgh, who was responsible for preparing the specifications and drawings covering all sections of the work.

The new works provide a modern plant of a capacity to replace the old carbonizing unit, and, with the carbonizing capacity at the other two works, to provide an adequate margin of capacity over the maximum day's requirements. The lay-out of the new plant is on lines capable of economical extension in the future with the object of ultimate centralization of production at these works.

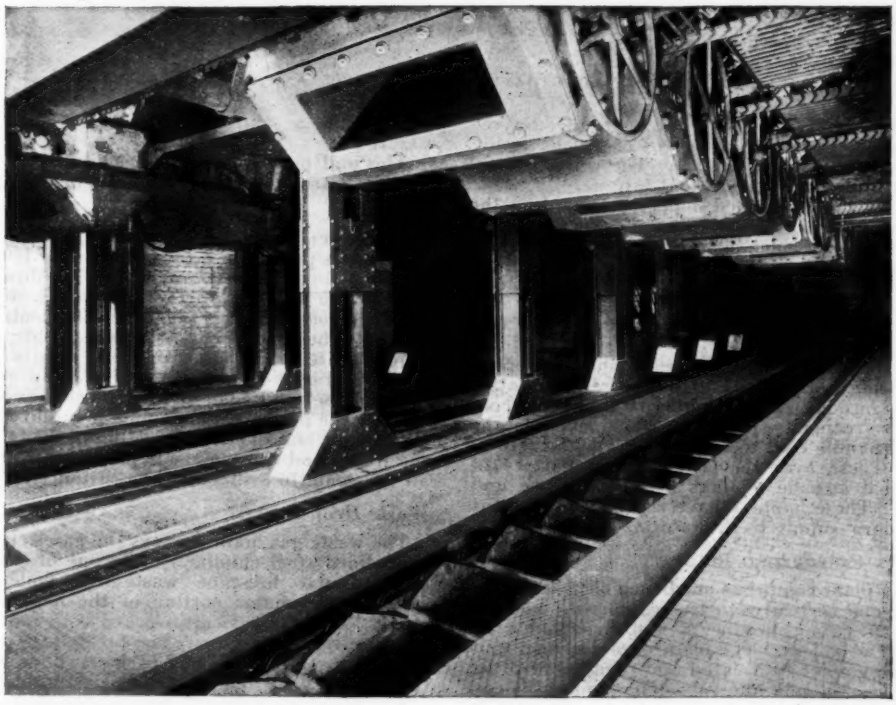
The new carbonizing plant comprises an installation of modern continuous vertical retorts, designed to employ the latest methods of mechanical charging and discharging of coal. It has a maximum carbonizing capacity of approximately 234 tons of coal a day and a corresponding output capacity of about 4¼ million c.ft. of gas. It is provided with a complete plant for the recovery of waste heat contained in the waste products of combustion.

The arrangements for the coal supply to the carbonizing plant and for the handling and treatment of the coke produced have been devised with a view to the maximum flexibility of operation combined with compact lay-out.

The conservation of all available heat and its most convenient application have received careful consideration in the positioning of the sources of heat and power in relationship to their points of use.

Coal Handling and Storage Plant.

The Fraser & Chalmers coal handling plant is arranged to provide two inter-related main systems of coal handling, one of 240 tons per hour capacity into the storage ground and one of 80 tons per hour capacity into the retort house, whether from the store or direct from the sidings. The plant has been designed to meet as simply as possible any set of requirements which may arise.



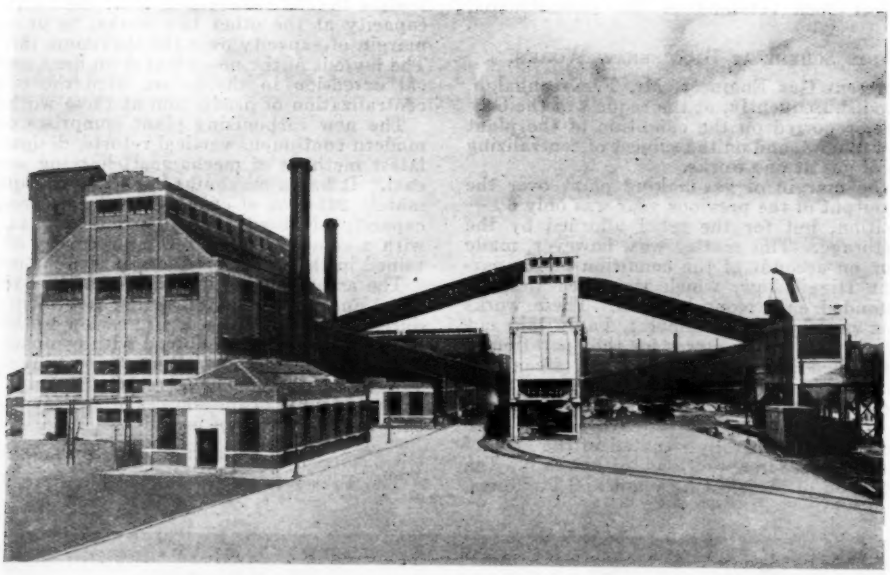
VIEW UNDER SETTINGS, SHOWING COKE DISCHARGERS, TRAVELLING CHUTES, AND LIP-BUCKET CONVEYORS.

The 20-ton railway wagons of coal are weighed on an Avery weigher and tipped by a Mitchell automatic tippler into a concrete receiving hopper. From this hopper the coal is withdrawn by two shaking feeders and fed on to an inclined belt conveyor of 240 tons per hour capacity, which carries it up into a junction house.

From the junction house the coal may go either to the storage ground for ultimate recovery to the retort house, or may, if so desired, be sent direct to the retort house.

Coal for open storage is fed by the main storage conveyor belt, which has a full capacity of 240 tons per hour, on to a travelling distributing tripper fitted with wing conveyors. This tripper travels up and down the middle of the storage ground on an elevated track and forms two longitudinal heaps.

Coal is recovered from store by a steam travelling grab crane operating on a track which runs at a distance of 50 ft. from the tripper track. Automatic free wheel tandem drums are embodied in the hoisting machinery and the grab is prevented from spinning by using four ropes. The revolving superstructure turns easily and silently on a ring



GENERAL VIEW OF COKE HANDLING, SCREENING AND STORAGE PLANT.

of live rollers running on a cast steel roller path. Swivelling bogies enable it to negotiate curves of 100 ft. radius and a differential gear is incorporated. The whole control gear is arranged to be operated without fatigue.

This crane fills a travelling feed hopper mounted on the elevated track behind the tripper. This hopper feeds the main storage conveyor, which is reversed and slowed to deliver 80 tons per hour into the junction house.

Here the coal may be fed directly on to an inclined belt conveyor, which has a capacity of 80 tons per hour and delivers it over a Westminster automatic continuous belt weigher into the retort house.

Coal too large for the retorts is passed through a Jeffrey crusher before being fed on to the conveyor. The latter conveyor delivers into either of two gravity lip-bucket conveyors of 100 tons capacity per hour which encircle the retort bench and handle coal to and coke from the retorts simultaneously. These take the coal up to a battery of steel overhead coal storage hoppers arranged above and along the bench. These hoppers have a capacity of about 530 tons, or 54 hours' supply to the retorts.

Carbonizing Plant.

The carbonizing plant comprises one bench of 28 Woodall-Duckham continuous vertical retorts, heated with hot gas from a battery of seven producers and provided with duplicate waste-heat boilers. The plant is so designed that one retort can be completely isolated and together with its own independent coal supply and subsidiary apparatus can form a complete coal testing plant.

Retorts.

The retorts are about 25 ft. high, rectangular in plan and tapered to allow continuous regular descent of the coal. They are 103 in. long and 10 in. wide at the top.

Special features of the retort design are as follows:

(1) Each retort is absolutely separate from the rest and can be heated up, cooled down or scurfed, without affecting the others.
(2) The retort faces and combustion chambers are of highest quality silica material for the full depth of the combustion chambers, which ensures high output and low maintenance costs.
(3) Zoning of heats can be varied to suit different types of coal by introduction of additional secondary air at a second point in the combustion chambers, while make of gas of different calorific values is obtained by simple adjustment of the steam valves at the base of the retorts.
(4) The side walls and top of the bench are specially insulated to improve working conditions and save fuel.

A dry type collecting main is provided on each side of the bench, and in this the gas is amply sprayed with hot ammoniacal liquor, the liquor falling to a central cleaning well where heavy tar deposits collect and can be removed. The liquor passes over a weir in the well to a tar and liquor separating system, whence it is pumped back, after straining, to the sprays in the main. A closed circuit is thus formed and an ample supply of hot liquor to the sprays is assured.

The pull on the retorts is regulated by two Arca regulators controlling butterfly valves in the uptakes.

Producers.

The seven producers which supply the gas for heating the retorts are set in a battery at floor level at one side of the bench. Any of them can be shut down without interfering with the working of the others, and the gas from any producer can be taken to the heating flues of any retort. The producers are of the step-grate type and have ample grate area for heating the retorts when burning a mixture of coke and breeze. Thus a low-quality fuel is put to good use, and coke of higher value is released for sale. To give the producers maximum flexibility, as regards both gas output and quality of fuel used, doors are provided on the fronts and arrangements made for injection of primary air by steam to overcome the resistance of the fuel bed.

Waste-Heat Boilers.

The waste gas main conveys the gases either directly to a brick-lined steel chimney, or to one of the two horizontal multi-tubular fire-tube waste-heat boilers provided for utilizing the major portion of the heat contained in the gases. These boilers are worked with induced draught by electrically driven fans. The boilers are designed to work at 160 lbs. per sq. in., and each can deal with the whole of the waste gases from the bench; one is thus a stand-by.

The plant gives greatly improved results when compared with the older method, and an official guarantee test of four weeks' duration showed that all the guarantees given as to throughput of coal, quality and quantity of gas made, fuel used in the producers, and make of tar, had been comfortably obtained and exceeded.

Coke Handling, Screening, Washing, and Storage Plant.

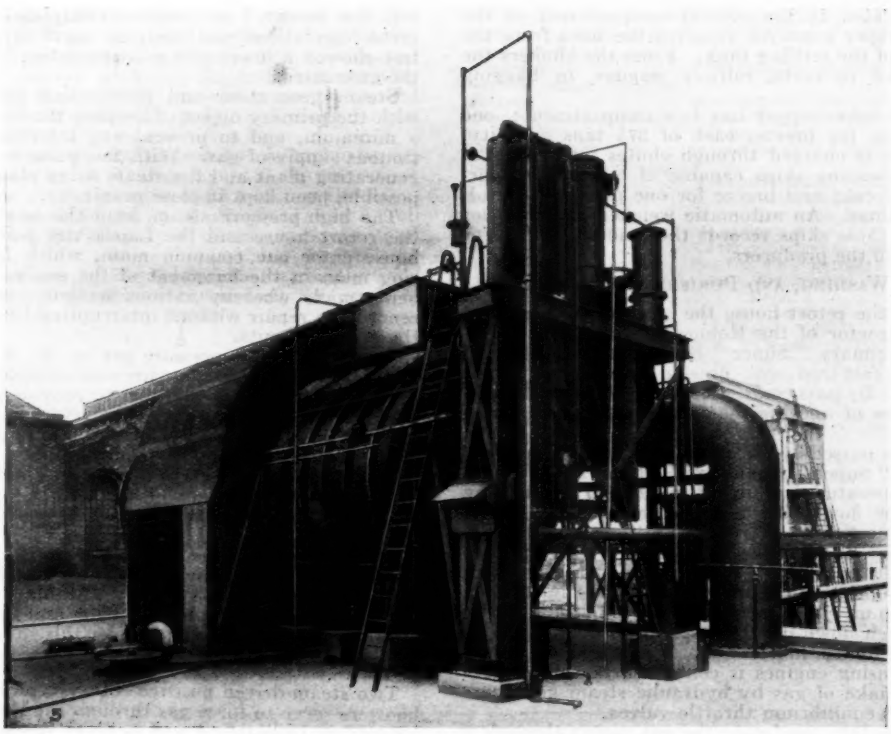
The Fraser & Chalmers plant for handling, screening, storing, and recovering coke is very complete and, like the coal handling plant, is flexible to meet all circumstances.

The coke from the retorts is discharged into the gravity lip-bucket conveyors by two travelling chutes on rail-borne bogies, one under each line of retorts. The chutes can be traversed, when required, to feed coke from one line of retorts into the conveyor under the other line.

The coke required for filling the retorts at starting up or after scurfing is tipped from the lip buckets into a 12-ton overhead storage hopper at the end of the overhead coal storage hoppers. Thence it is charged into a retort filling skip running on an overhead rail between the two lines of retorts.

The rest of the coke is discharged by the lip buckets into a hopper. This is a reinforced concrete structure with bunkers of the same material capable of storing in the nine compartments 400 tons of coke of various sizes.

In the screening house the coke is screened on Robins five-shaft grizzlies, double-deck Gyrex and single-deck Vibrex screens into the following coke sizes: Over 2½ in., 2½-1½ in., 1½-¾ in., ¾-⅜ in., and breeze ⅜-0 in. Two screens of each type are installed. Two bunker compart-



BENZOLE RECOVERY PLANT.

ments are provided for each size except the largest. Each bunker has three sliding outlet gates with chutes fitted, on the coke bunkers, with fixed screens for extracting any breeze made in filling the bunkers.

The coke or breeze may be discharged from any bunker for further handling by five distinct systems. It may be fed directly into wagons or carts for removal from the works. Secondly, it may be discharged into a travelling bagging weigher of the Richard Simon type, operating along a bagging platform. Thirdly, it may be fed by a travelling chute on to one of two belt conveyors, working from each end of the bunkers towards the centre. These conveyors may discharge on to an inclined belt conveyor of 50 tons per hour capacity which takes the coke back to the retort house for use in the producers or Lancashire boilers. Fourthly, the former two conveyors may deliver the coke on to an inclined belt conveyor, for delivery to an automatic skip-filling hopper from which it is removed by means of an overhead steam-driven crane to the coke storage yard.

As a fifth alternative the coke from $1\frac{1}{2}$-$\frac{3}{4}$ in. and from $\frac{3}{4}$-$\frac{3}{8}$ in. may be taken by means of the crane to a washing plant. Here it is fed into a receiving hopper of approximately 30 cwt. capacity. It is then fed by a rotary feeder through a two-way chute on to the appropriate side of a twin washer capable of dealing with each of the two sizes. Separation is effected by an upward flow of water through the washer by means of a centrifugal pump. The coke is carried over a weir to a straining screen and thence delivered to No. 1 compartment of the main bunkers. The water goes to a settling tank before re-circulation. The

THE ENGINE HOUSE.

sinkers are elevated to the central compartment of the bunkers. A scraper conveyor removes the fines from the hopper bottom of the settling tank. From the bunkers the coke is delivered to carts, railway wagons, or bagging machines.

The producer coke hopper has two compartments, one for coke and one for breeze, each of 37½ tons capacity. Thence the coke is charged through chutes into either of two producer charging skips capable of carrying a four-hours' supply of coke and breeze for one producer, in adjustable proportions. An automatic weigher and totalizer in the track of these skips records the amount of coke or breeze charged to the producers.

Cooling, Washing, and Purification of Gas.

After leaving the retort house the gas passes through a primary tar extractor of the Holmes Cyclone type. It is then cooled in primary "Super" condensers consisting of two columns of cast-iron with pressed steel doors, tubes, and tube plates. By-pass connections with Western double-faced valves allow of working the condensers in series or in parallel.

The gas is then passed by the exhausters into a secondary single column "Super" condenser, where it is finally cooled to a temperature within 5% of that of the cooling water, the water flow being automatically controlled by means of a thermostat.

The exhausters are of the four-blade type and are capable of delivering 200,000 c.ft. of gas against a pressure of 50 in. at the outlet and 6 in. vacuum at the inlet when running at 60 r.p.m. They are fitted with inlet and outlet valves of the screw-down disc type, 20 in. in diameter, and have automatic forced lubrication. The speed of the 80 i.h.p. non-condensing engines is controlled in correct proportion to the make of gas by hydraulic steam governors operating special equilibrium throttle valves.

From the secondary condenser the gas passes through a Livesey washer and thence into a Holmes double unit rotary brush washer with central enclosed reduction gear electrically driven.

The washed gas is taken to the existing beds of oxide purifiers for removal of sulphur compounds. A Connersville type positive air blower, coupled direct to the gearing of the rotary brush washer, has been installed to deliver air for regeneration of the oxide *in situ*.

Benzole Recovery.

After purification, the gas is debenzolized with oil in a Holmes rotary brush washer originally installed for naphthalene extraction. The wash oil, enriched with benzole and naphthalene, is treated in a Holmes patent oil regeneration plant for continuous regeneration. This plant comprises a preheater for raising the temperature of the oil, a still in which the crude benzole and naphthalene are distilled from the oil, a cooler for cooling the oil before returning it into circuit, and a thermostatically controlled fractionator in which crude benzole and naphthalene are simultaneously recovered. The plant is capable of recovering a high test crude benzole at the rate of one gallon per ton of coal carbonized.

The station meter is of the Holmes-Connersville positive displacement type, with self-cleaning impellers which have sufficient clearance to avoid wearing of casings, so that accuracy is always maintained. The bearings are accessible and the gearing runs in oil. A recording instrument shows temperature, pressure, and make of gas. The meter has a normal capacity of 6 million c.ft. per day and is guaranteed accurate at 1% from 600,000 to 9,000,000 c.ft. per day with a differential pressure loss of less than 1 in. W.G. for the normal throughput.

Power Generation and Steam Supply.

A prominent feature of the new plant is the electrical generating installation supplying current for the conveyors, breakers, tipplers, fans, extractors, skips, &c.

Steam in large quantities is available as a recoverable bye-product of the carbonizing process, and if it is produced at a reasonably high pressure in the waste-heat boilers, can be made to give all the necessary power for driving the generators and still be exhausted at a pressure suitable for the retorts and producers.

This is made possible by an ingenious control mechanism fitted to the compound steam engines, which passes the steam from the engine receiver between the cylinders just as and when required. This is a new departure in plant of this character and its success has thoroughly justified its adoption.

There are three electric generating sets each capable of developing 125 KW. continuously, with an overload capacity of 25%. The three engines are of the enclosed compound pass-out type with forced lubrication. The compound-wound generators have three wire connections to enable 440 and 220 volt circuits to be used. Engines and generators are mounted on combined bedplates on massive concrete foundations and there is no vibration. The official test showed a lower steam consumption in each case than the guarantee.

Steam generation and distribution has been designed with the primary object of keeping the heat losses down to a minimum, and to prevent any interruption in the continuous supply of gas. With this point in mind, the steam generating plant and the steam using plant have, as far as possible, been kept in close proximity.

The high-pressure steam from the waste-heat boilers in the retort house and the Lancashire boilers in the boiler house enter one common main, which forms a complete ring main in the basement of the engine house, provision being made whereby various sections can be isolated for renewal or repair without interrupting the steam supply to the stand-by units.

Steam at 30 lbs. pressure per sq. in. is passed out from between the high and low pressure cylinders of the engines driving the electric generators to provide process steam for the retorts and producers in the retort house. All engines exhaust into a common collecting main against 5 lbs. pressure. From this main steam is taken through an oil separator for heating the feed water for the boilers, for heating water by means of a calorifier for the bathrooms, &c., and also for heating the various buildings on the works.

The free space in the angle between the boiler house and the back of the engine house is earmarked for a future water gas plant, an extremely suitable site having regard to the continuous supplies of steam and the ease of extending the coke storage bunkers over this site.

Boosting and Compressing Plant.

Two steam-driven positive rotary type four-blade Waller boosters serve to force gas through the booster main to the holders at Hollinwood and Central Works. Each can deliver 250,000 c.ft. of gas per hour against a pressure of 40 in. when running at 60 r.p.m. They are designed to avoid pulsation in the delivery main. They are driven by horizontal non-condensing steam engines capable of 65 i.h.p. with steam at 140 lbs. per sq. in. Diaphragm governors in the delivery main actuate equilibrium steam throttle valves on the engines to control running speed. A relief valve on the by-pass between inlet and delivery main forms a second safeguard.

Two small rotary three-blade Waller compressors supply gas to a high-pressure lighting system. They are steam engine driven, water-cooled, and anti-pulsating. Their speed also is controlled by diaphragm governors and by-pass relief valves. To prevent damage by overspeeding owing to sudden loss of load the engines are fitted with Pickering centrifugal governors.

The reconstructed Works at Higginshaw, forming as it does the first stage of the Gas Committee's policy of ultimately centralizing production there, necessitated the linking together of the gasholders at the Higginshaw, Central, and Hollinwood Works by means of a booster main. The main is 24 in. in diameter and 7200 yards in length. The laying of this main was commenced in July, 1931, and completed in August, 1932. The pipes were made locally and the work of main-laying was carried out by a local contractor under the direct supervision of Mr. Ernest Parry, the Commercial Manager.

The engine house measures 100 ft. long by 50 ft. wide by 21 ft. to the eaves, with a pump house arranged at one end, and is situated at the corner of the retort house. This house contains, as far as possible, the whole of the steam-using plant—namely, three steam-driven generating sets, two steam-driven coal gas exhausters, two steam-driven boosters, and two steam-driven gas compressors, with provision for further plant as required. A complete gauge board to assist the staff in obtaining the highest efficiency from the whole of the gas plant is arranged at the floor level.

The building is a steel framework with brick filling, the exterior face of the walls being faced with Accrington bricks and terra cotta. The interior walls are finished with glazed grey and white tiles, and the floor with black and white tiles.

A 5-ton overhead hand travelling crane is arranged to travel the full length of the engine house, and all the steam and gas mains are arranged in a suitably designed basement.

The boiler house is situated at the back of the engine house and adjacent to the retort house, and on the ground floor contains two Lancashire boilers with provision for a third.

The boiler house is built on similar lines to the retort house and measures 44 ft. long by 74 ft. wide by 36 ft. 6 in. to the eaves.

On the floor above the boiler is situated the men's mess room with bathrooms, clean and soiled locker rooms, and

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shift engineer's office. These have been designed with the idea of easy access from the retort house and proposed future carburetted water gas plant house, and so arranged that the men on leaving work can discard their working clothes in the soiled locker room, proceed to the baths, and then obtain their clean clothes from the clean locker room with every facility.

The laboratory, built on similar lines to the engine house, measures 61 ft. long by 30 ft. wide by 14 ft. to the eaves, and is arranged in such a position as to assist in the scientific control of the whole of the gas-works plant, and is well equipped with coal sampling, tar testing, balance, and calorimeter rooms.

Every effort has been made to provide extremely good day-time lighting and ventilation throughout the whole of the new buildings.

CONTRACTORS AND SUB-CONTRACTORS.

Carbonizing plant	Woodall-Duckham Vertical Retort and Oven Construction Company (1920) Ltd., London.
Coal and coke handling and screening plants	Fraser & Chalmers Engineering Works, Erith
Coal crane	T. Smith & Sons, Ltd., Rodley, Leeds.
Exhausters, boosters, and compressors	G. Waller & Son, Ltd., Stroud.
Condensing and washing plant, meter, benzole plant	W. C. Holmes & Co., Ltd., Huddersfield.
Electric generating sets and engine house steam range	Ashworth and Parker, Bury. General Electric Company, Ltd., Birmingham. John Thompson & Sons, Wolverhampton.
Engine house, meter house, laboratory, and concrete roadways	T. Partington & Sons, Chadderton.
Overhead crane (engine house)	H. Morris & Sons, Ltd., Loughborough.
Boiler house and messroom	Whitworth Whittaker & Co., Ltd., Oldham.
Tiling	Maw & Co., Ltd., Jackfield, Shropshire.
Patent glazing and steel windows	Mellowes & Co., Ltd., Sheffield.
Shuttle band conveyor	R. Dempster & Sons, Ltd., Elland.
Boiler house chimney	R. & J. Dempster, Ltd., Manchester.
Coke washing plant	M. B. Wild & Co., Ltd., Birmingham.
Lancashire boilers	Tetlow Brothers, Hollinwood.
Steam piping and covering	Bolton's Superheater and Pipe Works, Ltd., Stockport.
Gas pipes	Platt Bros. & Co., Ltd., Oldham. Stanton Ironworks Company, Ltd., Nottingham.
Laying of booster main	F. G. V. Freeman, Hollinwood.
Sewage plant	Wallwin (Pumps), Ltd., Warwick.
Heating installation	Saunders & Taylor, Ltd., Trafford Park.
Railway extensions	E. Sisterson, Ltd., Newcastle-upon-Tyne.
Dust collector	Davidson & Co., Ltd., Manchester.
Vacuum cleaning plant	Sturtevant Engineering Company, Ltd., London.
Electric motors	Lancashire Dynamo and Motor Company, Ltd., Trafford Park.
Switchgear	Brookhirst Switchgear, Ltd., Chester.
Electric wiring	W. J. Furse & Co., Ltd., Manchester.
Instruments and gauge board	George Kent, Ltd., Luton.
Demolition contractors	T. Maiden, Manchester. Walter & Co. (Oldham), Ltd., Oldham.
Reinforced concrete structures and piled foundations	Lotz and Kier (J. L. Kier & Co., Ltd.), Stoke-on-Trent.
Consultant engineers for ferro-concrete work	L. G. Mouchel & Partners, Ltd., London.

THE "JOURNAL"
TECHNICAL RECORD

Which contains Reports of Meetings of Gas and Allied Associations

North of England Gas Managers' Association

A Noteworthy Annual Gathering

Two topical papers and an exceptionally strong attendance of members marked the Annual Meeting of the Association, which was held in the County Hotel, Newcastle-upon-Tyne, last Friday. Mr. A. Clement Hovey brought to a conclusion his year of office as President, and Mr. A. Pickering, of South Shields, was elected his successor.

Reception and Luncheon.

There was a reception by the President in the morning, which afforded members an opportunity for conversing that the business meeting cannot provide. The reception was followed by an informal luncheon in the hotel, to which round about one hundred sat down. Mr. Hovey was in the chair, and, in the course of a few remarks, said it was a great pleasure to be able to welcome among them Mr. R. E. Gibson, President of the Institution of Gas Engineers, who had honoured them with his presence. It was nice to find Presidents visiting in this way. He himself, during his year as President of the North of England Association, had visited the districts of over 95% of the members of the Association, and in every instance it had proved well worth doing, because of the warm welcome he had received.

Mr. R. E. Gibson, being called upon, expressed his pleasure at being with them that day. It had, he said, been his endeavour during his year of office so far as possible to attend at least one meeting of the various Associations affiliated with the Institution, though circumstances had unfortunately prevented him from entirely carrying out this intention. Such visits gave him the opportunity of expressing the good wishes of the Institution to the members of the Affiliated Associations, and of saying how much the good work that these Associations were doing was appreciated. The Institution of Gas Engineers owed much to the members of these Associations. With regard to the North of England Association, the Institution was fortunate in having on the Council at the present time some able members of that body. Mr. Hovey himself was a highly valued member of the Council, for he could discuss things from two points of view. He was a contractors' man, and he had had a large experience of engineering over a very considerable period. They all remembered his excellent Presidential Address to that Association, which dealt with every phase of the Gas Industry in a very thorough manner. The Institution had also on its Council Mr. F. P. Tarratt, who was now its Senior Vice-President, and who would shortly be succeeding him (Mr. Gibson) in the office of President—an office which he was convinced Mr. Tarratt would fill with great credit to himself and honour to the Institution. There was also Mr. J. R. Bradshaw, who was a very useful member of the Council. Mr. J. E. Blundell, too, had been an extremely helpful member of the Council, and he hoped he would soon be on it again. Mr. H. E. Copp, a recent Past-President of the Institution, was also a member of their Association; while they had among them that day as their guest Mr. David Fulton, of Helensburgh, who was another helpful member of the Institution Council.

Mr. F. P. Tarratt was also called upon by the President, and, referring to Mr. Gibson's remark that he would soon follow that gentleman in the Chair of the Institution, said he felt assured of the heartiest support of the members of the North of England Association, to make his path as easy as possible.

Business Meeting.

After the minutes of the Autumn Meeting had been taken as read and confirmed, the President referred to the death

of two members of the Association—Mr. Matt. Dunn, of Darlington, who died in November last, and Mr. J. W. Wilson, of Leeds, who passed away in December. Mr. Dunn had been President of the Association in 1901-2, and was Chief Engineer to the Stockton Corporation Gas and Water Department for many years. Mr. Wilson was well known on the manufacturing side of the Industry, particularly in connection with the making of apparatus for the consumption of gas. They were all sorry to lose these two old members.

The Report and Accounts were next adopted, the PRESIDENT remarking that the latter showed a very strong financial position.

Dr. J. T. DUNN, the Newcastle City Analyst, expressed his thanks to the Association for having voted an amount as a guarantee in respect of the expenses of the annual conference of the Society of Chemical Industry, of which he has been elected President for the year 1933-1934.

A STUDENTS' FUND.

The PRESIDENT said that, before dismissing the subject of finance, he had a proposition which he wished to submit to the meeting. The accounts showed a very strong financial position—the assets of the Association being substantial. These assets had been steadily accumulating apart from the enhanced value of the investment in the ordinary stock of the Newcastle-upon-Tyne and Gateshead Gas Company. As a matter of fact, the present value of the assets was definitely £840, and he suggested to them that the "wise spending" of the Association should be extended. To this end his proposals were:

1.—That the foundation of a Fund should be laid by setting aside the sum of £250, which was 30% of the present value of the assets.

2.—That the interest earned by this Fund should be applied annually to assist and encourage in their work the students of the Association.

3.—That the Fund should be known as the "Students' Fund."

If these proposals received the approval of the members, he would at once ask their acceptance from him of a similar capital sum to augment the Fund. He might in this way be able to give some evidence of his admiration for the sterling qualities, and his appreciation of the helpfulness, of the members of the Association during his experience of 35 years of membership, and also his sympathy with the younger men in these difficult days in their keen endeavour to become proficient in a splendid Industry, which largely depended upon their enthusiastic, efficient, and unwearing efforts in all its sections.

The proposal was put to the meeting and agreed to with acclamation, and Mr. Hovey handed over his cheque for £250 to the Hon. Secretary, adding that he hoped the Committee would not be afraid to encourage other contributions.

It was decided to leave the matter in the hands of the Committee.

Mr. HERBERT LEES (Hexham) moved a hearty vote of thanks to Mr. Hovey. There were not, he said, the facilities for gaining knowledge thirty and more years ago that existed to-day. The teacher himself then was a student. He had to be, to keep abreast with the times.

Mr. C. DRU DRURY (Sunderland), seconding the vote, said that there was no better object than that of furthering technical education. The better young men were prepared and educated, technically and generally, the better they would be prepared to carry on in industry. The older they got, the more they realized that they were still learning. He appealed to all administrators in the Gas Industry to see that their young men were thoroughly trained and educated.

The vote of thanks having been carried with applause,

The PRESIDENT said that, as they had accepted the cheque, he hoped they would accept the scheme also. [Laughter.] The Committee would formulate it on a proper basis, and he hoped it would continue successfully. He realized the difficulties which the young men were meeting to-day in their keen endeavour to become thoroughly proficient.

It was decided to contribute a donation of 10 guineas to the Benevolent Fund of the Institution of Gas Engineers.

THE PAPERS.

The following two papers were then read, and will be found (with reports of the discussions) on later pages of this issue of the "JOURNAL":

"Refractory Materials and the Gas Industry—A Progress Report," by Mr. A. T. Green, F.I.C., F.Inst.P., Assistant Director of the British Refractories Research Association.

"The Preparation and Sale of Gas Coke," by Mr. T. Hornby, of Hessle.

Mr. J. R. BRADSHAW proposed a vote of thanks to the authors for their papers, which was seconded by Mr. H. P. ALLISON.

Mr. J. E. Blundell was elected representative on the Council of the Institution of Gas Engineers.

The HON. SECRETARY (Mr. H. Douglas Lees, of Hexham) read the election of officers according to the scrutineer's report.

NEW OFFICERS.

President.—A. Pickering, South Shields.

Vice-President.—R. H. Duxbury, South Bank.

Committee.—J. Corrigan, Penrith; W. M. Galleway, Whitby; J. R. Henderson, Wallsend.

Hon. Secretary.—H. D. Lees, Hexham.

Hon. Treasurer.—C. H. Armstrong, Newcastle.

PRESIDENTIAL CERTIFICATE.

A Presidential framed certificate was presented to Mr. A. C. Hovey, the retiring President, to mark his year of office, by the President-Elect, Mr. Pickering, who referred to Mr. Hovey's invaluable work for the Association during his long membership, and to the work which he had accomplished during his year of office.

Mr. PICKERING, returning thanks for having been elected President, said that he believed he was the sixth President that the Association had found from South Shields.

Mr. F. C. WILLIS proposed a vote of thanks to the Officers and Committee for their services during the year, which was seconded by Mr. J. B. HENDERSON and carried heartily.

The date and place of the next meeting was left to the Committee, and the afternoon's proceedings closed with tea being served in the lounge of the hotel.

Solving a Problem of Ground Subsidence.

Ground subsidence is a frequent cause of severe damage to rigidly jointed pipe mains. In colliery districts especially, the considerable degree of ground subsidence due to undermining often creates a serious problem for the engineer. A satisfactory solution of this problem is offered by the Stanton-Wilson self-adjusting joint, which enables mains to be deflected without leakage under high or low pressures.

A notable example of the success of this joint under exacting conditions is provided by a low-pressure gas main recently laid through Warsop by the Shirebrook and District Gas Company, where there is a large degree of ground movement.

Mr. G. Stevenson, Managing Director and Engineer of the Shirebrook Gas Company, realized after practical experience that it was impossible to provide a permanent installation with cast-iron mains fitted with the ordinary type of lead-caulked joint. He accordingly decided to substitute spun iron pipes jointed with the Stanton-Wilson self-adjusting joint. The laying operation was carried out with ease and rapidity, and on completion the main was subjected to a test-pressure of 25 lbs. per sq. in. The result of the test was in every way satisfactory.

Since it was laid in July, 1932, the behaviour of the pipe has been tested from time to time, and there are no signs of leakage, notwithstanding the fact that the ground is still unstable and difficult.

All engineers familiar with the limitations of the ordinary run-lead or lead wool joint will realize that under conditions such as these it could not be expected to remain leak-tight. Although lead yields to a new formation, its lack of resilience prevents it from readjusting itself, and any ground movement due to undermining or traffic vibration is likely to cause serious leakage.

The Stanton-Wilson self-adjusting joint, which operates on the stuffing-box principle, endows cast-iron mains with a flexibility sufficient to meet the most exacting conditions. The joint also permits a considerable degree of expansion and contraction. Owing to the rapidity with which it can be made, its cost, it is stated, is no greater than that of a lead joint.

The makers claim that the joint is in every respect superior to any type of caulked joint, and that the Shirebrook and District Gas Company's experience is only one of many examples of its efficiency.

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Refractory Materials and the Gas Industry—A Progress Report

By A. T. Green, F.I.C., F.Inst.P.

[A Paper before the North of England Gas Managers' Association.]

Your President's survey of the Gas Industry gives a clear-cut impression of its progress and present magnitude. He makes progress the keynote of the address. In the circumstances, I have been tempted to follow his lead and to amplify his commendatory paragraph on the progress of the study of refractory materials. In so doing, I hope to show that the continued interest of the Gas Industry in such investigations has been more than justified.

The desire for increased efficiency in the manufacture of gas focussed conspicuous attention on the properties of refractory materials, and, in 1909, the Refractory Materials Joint Sub-Committee of the Institution of Gas Engineers and the Society of British Gas Industries was formed. Under the ægis of this Committee, Dr. Mellor carried out many valuable preliminary investigations. In 1917, a grant-in-aid of £1,000,000 was voted by Parliament for the establishment of industrial research associations. About fourteen years ago, manufacturers and users of refractory materials, particularly including members of the Joint Sub-Committee, decided to approach the Department of Scientific and Industrial Research, with the result that the British Refractories Research Association was born on April 14, 1920. From this date to the present time, the Joint Sub-Committee, while maintaining a virile individuality, has co-operated with the Association, has guided its special interests, and has allowed its investigations to be merged with the general research programme to mutual advantage.

At the end of the present year, ending June 30, the B.R.R.A. will have published at least thirty bulletins containing a total of over 150 papers and reports of the investigations. Up to a year ago the research staff, including the Director, had rarely exceeded twelve, and the total expenditure was rarely more than £4500 a year—a totally inadequate amount. The progress realized could not have been made without the guiding genius of the Director. Last year saw a crisis in the history of the Association, and it is a pleasure to report that the Gas Industry did more than its share in responding to an urgent appeal and, therefore, in supporting the continuance of the work on a more ambitious scale.

In an early review of the work, then in progress, the Director wrote: " I take it that the purpose of our Association is to make a special and concentrated study of the commercially available materials and of the processes of manufacture, so that products can, by a succession of small advances, be improved." Such a purpose, including, as it does, the prosecution of fundamental research, is surely helping to make a solid technical foundation for the refractories industry.

The main object of the present essay is to indicate the work of the Joint Sub-Committee and the B.R.R.A. in furthering the study of refractory materials, during the past decade or so. In the space available I cannot do more than give a brief outline, and, in consequence, I have chosen certain themes more from personal interest than relative importance.

Notes on the Standard Specifications.

As early as 1912 certain specifications for gas-works refractories were drawn up, in the form of a brochure, by the Joint Sub-Committee. Modifications were suggested from time to time, with the result that revised specifications were introduced in 1922 and amended in 1925. Although attention is drawn to the apparent porosity, the crushing strength and, in the case of silica products, the true specific gravity, &c., the three tests (1) chemical analysis, (2) refractoriness, and (3) after-contraction or expansion remain the major criteria in the selection of fireclay, silica, and retort materials. The chief function of chemical analysis is to place the common refractories into the categories of aluminous firebrick, firebrick, semi-silica, siliceous, and silica products. It also shows the amounts of constituents, of which lime, magnesia, iron oxide, and alkalis form the basis. Thus any excess of the ferruginous compounds in firebricks, or lime compounds in silica bricks is made apparent.

Refractoriness implies the resistance of a refractory to the influence of very high temperatures. It is clearly recognized that this softening is not a specific property analogous to true melting, but involves both time and temperature factors. This recognition is of the utmost importance in emphasizing the arbitrary nature of the conception of refractoriness and the difficulty in assessing " signs of fusion."

Considering the phenomena associated with the bending or squatting of a cone of a refractory, T. F. E. Rhead and R. E. Jefferson* made the following interesting comments: " When heated with the base in the horizontal position, the cone is subjected to two forces tending towards deformation—viz., its own weight and its surface tension. These forces are resisted first by cohesion, and, as this decreases by rise in temperature, by internal friction or viscosity. It is evident that the weight or load is greatest in the bottom layer under the apex; hence, the internal friction will be overcome at this point first, thus causing the cone to tilt and then progressively to bend over. It is assumed that the cone is heated uniformly throughout the mass. A symmetrical cone with the apex over the centre of the base is more likely to squat on itself and not bend like the Seger cone, which has the apex over one corner of the base owing to one edge being perpendicular to the base. With some materials the force of surface tension plays the major part in causing deformation—*e.g.*, Fieldner, Hall, and Field have demonstrated that it is possible to heat cones of certain coal ashes in a horizontal position supported only at the base and even under these extreme conditions ' the material collects in the form of a blob, before it has had time to bend under its own weight.' " These comments are sufficient to show that, if the refractoriness test is to give comparative information, the size and shape of the test piece must be standard, the conditions governing the test strictly controlled, and the interpretation of " signs of fusion " rigidly comparable. Although it has always been difficult to standardize the interpretation of " signs of fusion," the refractoriness test has been the *sine qua non* of selection.

The changes which occur during the firing of refractory materials belong to a class known as " arrested reactions." In these the chemical and physical changes are arrested at particular and definite stages before they are completed. When firebricks are burned the fluxes tend to melt and to dissolve the less fusible substances, binding the whole more or less firmly together. A certain amount of contraction occurs during the operation and if not completed during the firing of the brick it will subsequently continue when the brick is in use. This is called after-contraction. If this after-contraction is considerable, the masonry of the furnace will most certainly be displaced when in operation.

Straight silica bricks usually show an after-expansion consequent on the more or less gradual change of the quartzitic silica with a specific gravity of 2·65 to one or both of the two other varieties—cristobalite and tridymite—with specific gravities of 2·32 and 2·28. It is essential that silica bricks to be used in the construction of gas retorts shall have low values for the after-expansion and for the true specific gravity, otherwise serious strains in the structure will be set up during the working of the retort.

In the case of semi-silica or highly-siliceous clay-bonded products, the tendency is to obtain a product which does not show either after-expansion or contraction. This volume constancy is an advantage, giving such products definite fields of application. There cannot be the slightest doubt that the application of the after-contraction or expansion test has been of the greatest value to the Gas Industry. It has obviously resulted in an improvement in the texture of firebricks and silica products and an increase in the maximum temperature of the firing operation. It has helped to pave the way to a fuller appreciation of the constitution of silica products.

The specifications at present in use are obviously neither elaborate nor rigid, for our knowledge of many phases of the subject is incomplete. Again, that stage of the science of selection, based on an adequate appreciation of all the factors relating to the use of refractories, has not been reached. Dr. Mellor adequately sums up this state of affairs when he says that " the manufacturer who seeks to develop particular properties in his bricks, especially fitted for particular purposes, is often handicapped by competition against bricks made possibly with good refractory clays but in which no attempt has been made to control the product. This may appear to be unfair, but the injustice will prevail so long as the criteria of the quality of firebricks for specific purposes remain indeterminate."

During the past five years or so the B.R.R.A. has made

* Trans. Ceram Soc. **25**, 6, 1926.

efforts to define the actual conditions which influence the durability of gas-works' refractories. This work, which is exceptionally difficult, will be discussed later.

Properties of Refractory Materials.

Mechanical Strength at High Temperatures.

As already indicated, the specifications drawn up and published by the Institution of Gas Engineers include, probably as a first consideration, the determination of the refractoriness value. This test gives no indication of the conjoint influences of pressure and temperature, a state of affairs more often encountered in industrial usage than the effect of temperature, *per se*.

It is very necessary to have information indicating the refractoriness-under-load because the economics of furnace design follows an appreciation of these data. The study of this test has proceeded for the past twenty years. The original work, completed in this country for the Joint Sub-Committee, has been continued by the Research Association, and valuable modifications have been introduced. Important guiding data, which have proved fundamental to our conception of the structural stability of high-temperature installations, have been obtained. For instance, the independent effects of load, temperature, and time on the deformation of typical fireclay products have been examined. As a result of this work, the viscous flow and plastic flow of firebricks, and, consequently, the conditions giving rise to appreciable contraction at high temperatures, have received some definition. Thus, the need for the limitation of the temperature of usage of different products became evident. The refractoriness-under-load behaviour of a silica product has been shown to be very different from that of a firebrick. Usually the superior silica product does not show appreciable signs of deformation in the normal under-load test, even under a load of 50 lbs./sq. in., until a temperature of 1660° or over has been reached.

Research has indicated that it is desirable to carry out, at least, two tests on the same material, one with a high loading, say, 50 lbs./sq. in., and the other with a low loading of 10 or 4 lbs./sq. in., obtaining the progressive change in the linear dimensions of the specimen during each test. In order to interpret the tests adequately it is necessary to consider (*a*) the temperature at which subsidence becomes apparent; (*b*) the temperature at which a marked acceleration in the rate of subsidence occurs; (*c*) the subsidence ranges; (*d*) the effect of load on the temperature extent of the subsidence range; and (*e*) the appearance of the pieces after testing.

There can be no doubt that the application of this test has resulted in considerable improvements in the texture of the commoner refractories, and this has reacted very favourably on their durability in practice. However, it should be emphasized that there are many aspects of the mechanical properties of refractory materials at high temperatures which have, up to the present, received little or no attention. In fact, a considerable field requires exploration. In the main, stability at high temperatures has been investigated from the viewpoint of one test; its broader and more fundamental significance calls for considerable study.

Thermal Properties.

Owing to the overwhelming necessity for fuel conservation, the efficiencies of high-temperature installations must continue to receive considerable attention. These efficiency factors cannot be computed without the aid of data concerning the essential thermal properties of the materials of construction used in building high-temperature furnaces.

A very appreciable amount of data, including the measurement of thermal conductivity, temperature diffusivity, specific heat, and heat capacity of silica, fireclay and magnesite products has been reported during the past ten years or so. In connection with the data obtained on the coefficient of thermal conductivity a number of interesting points have been recorded. Some of these may be summarized as follows: (1) In the case of silica and fireclay products, the coefficient of thermal conductivity increases with temperature; in the case of magnesite products the bulk of the evidence points to a decrease, particularly at high temperatures. (2) The thermal conductivities of fireclay and silica products, although varying in the different materials, are, nevertheless, similar. It has been proved that good or first-class silica and fireclay products have very similar average values for the coefficient at lower temperatures, but that the silica has a higher value at higher temperatures. (3) Increasing the original firing treatment of a silica or a firebrick increases the conductivity. (4) Often the continued use of a refractory material results in an increased conductivity. (5) There is a relationship between the texture, porosity, and thermal conductivity of a refractory product.

An appreciation of the data reported on the specific heat of refractory products indicates clearly that brickwork at high temperatures acts as a reservoir of heat. Further, the value of this property for the commoner refractories increases with temperature, so that at a temperature of 1200° it is increased by nearly three-quarters of its value at ordinary temperatures. Such data are essential to a consideration of the thermal efficiency of regenerators and of the heat loss in the structure of an intermittent furnace.

There is much evidence that considerable fuel value is lost by way of the walls of gas-making installations, and, further, that this loss is greatly increased by the utilization of higher combustion chamber temperatures. Thus, the trend of modern design of both vertical and horizontal settings makes the use of adequate methods of insulation a necessity. In this connection it is of interest that the study of the thermal properties of refractory materials led to investigations of the properties of insulating materials, followed by an extended exploration of their application to retort settings. In this later work it was indicated that diatomite products have a wide application in the carbonizing industry. Further, it was shown that a preconceived disposition of insulating materials based on an appreciation of their properties, the behaviour of the refractory in the setting, the peculiarities and functions of the plant, is very desirable; and that insulation as an afterthought requires very careful consideration.

When design involves external insulation there are strong arguments for building-in the insulating brickwork after the setting has attained working temperatures. This work and the investigations of other research workers stimulated greater interest in the subject of insulation and gave a lead in the assessment of the desired properties of diatomite insulating bricks. Recently it has been proved that the diatomite product, in spite of its high porosity, has a very low value for the permeability to gases, a property which must be of value in a furnace structure.

Texture, Porosity, and Permeability.

It was early realized that the texture of a ceramic product has an important bearing on those properties which determine its industrial usage. Consequently, from time to time work on the relationship of texture to other properties has appeared. Porosity, considered as a general property, is intimately associated with texture. However, the degree of porosity, which is measured by the percentage of voids in the total volume, gives no indication of the nature, size, and distribution of the pores. It is not surprising, therefore, that, in search of greater definition, properties which are dependent on the characteristics of the pores have, recently, formed the subject of extensive research. Permeability, defined as the readiness with which a gas will pass through a refractory under a definite pressure, is such a property. It is capable of quantitative measurement and depends on the number, arrangement, and average dimensions of the open pore spaces.

Taken in conjunction, the measurements of permeability and porosity will yield information which neither can give independently. In fact, from them we can obtain values for the average size of the pores and for the number in a given cross-section. This is a definite step forward in the study of the texture of refractory materials. Some of the points of interest arising out of the study of permeability may be briefly summarized:

(1) Almost without exception the permeability of a variety of standard-sized bricks was found to be least when measured perpendicular to the 9 in. by 4½ in. face. Whatever the complete explanation, it is unquestionable that the pressure used in making bricks of these dimensions, whether applied mechanically or by hand, plays a great part in giving a directional nature to the grains.

(2) The development of a dense, superficial layer is distinguished by the measurement of permeability.

(3) As it is often asserted that the main leakage in gas retorts occurs at the joints, it is necessary to measure the permeability of the material in order to vindicate the assertion. In consequence, it has been proved that, for vertical retorts, the loss by way of the pores of a brick can only be a comparatively small proportion of the total leakage.

(4) In so far as the deterioration of a refractory product is due to penetration by vapours, fine solid particles, and by corrosive slags, the property of permeability will be an important factor.

Silica Products.

With the increasing flue temperatures and outputs many carbonizing units in this country have been converted to the use of silica products. Investigations on these materials

have proved of great value to the manufacturer in teaching him what products to make, and to the user in teaching him the correct appreciation of their properties. Most of this work has been consummated during the past ten years.

The constitution of silica products, in general terms, is now appreciated by the well-informed in the Gas Industry. In a well-burned " straight " silica product the three crystalline forms of silica—namely, quartz, cristobalite, and tridymite—together with a small amount of a glassy matrix of calcium alumino-silicate, may be present. The behaviour of such a material during the preliminary heating of the setting and its subsequent operation is somewhat complex, for we have to consider (1) the normal reversible expansion of the setting; (2) those reversible expansions taking place at certain definite low temperatures and due to the polymorphic changes in the cristobalite, tridymite, and quartz; and (3) an irreversible change due to the constitutional alteration of the residual quartz to cristobalite and tridymite at high temperatures.

The first-mentioned class *per se* presents no difficulties. The second class, known as inversions, is associated with very appreciable volume alterations, the largest of which may amount to 3% of the original volume of the material. Since these changes take place rapidly, they can introduce serious strains in the refractory structure, with consequent weakening and sometimes with disintegration. It is evident then, that the initial heating of a silica setting must be conducted with extreme caution until a temperature of 650° or 700° C. is reached.

The " growth " of silica structures in operation has caused much concern to gas engineers. It is due to the transformation of any residual quartz in the silica refractory to the low specific gravity forms, which takes place at temperatures of 1200° or over—that is, at carbonizing temperatures. The expansion taking place as the result of these transformations during the working of the retort is sufficient to cause cracking of the structure, owing to the inability of the latter, with the ironwork in position, to allow relief of the strains.

Among the investigations on silica products carried out by W. J. Rees and W. Hugill as part of the research programme of the B.R.R.A., the effect of repeated burnings on the structure and properties of lime-bonded bricks proved a very interesting one. The results show that the major part of the quartz conversion is accomplished in the first burn, and that the proportion of unchanged quartz decreases steadily until the seventh burn. The porosity decreases while the crushing strength increases up to the seventh burn. The results emphasize the necessity for a soaking period in the firing of silica bricks. The question is often asked as to whether a lime-bonded silica brick is better than a clay-bonded product. The same investigators conducted a long and arduous study of this problem. Clay-bonded and lime-bonded silica bricks were made on a large scale, under ordinary manufacturing conditions, and compared side by side, in industrial furnaces. The general indication is that there is no particular advantage in substituting the clay bond for the lime bond, but that under special conditions, wherever spalling difficulties are causing serious trouble, clay-bonded bricks may give better results. Other work has been directed towards elucidating the factors influencing the constitution of silica bricks and the relationship of this constitution to industrial service.

Durability of Refractory Materials.

Going hand-in-hand with investigations of the more fundamental properties, the definition of the actual conditions obtaining in the industrial usage of refractory materials is an essential. The systematic study of gas retorts after their effective life forms a source of valuable information. In this work information concerning (1) the internal dimensions of the retort at all levels; (2) the condition of the retort brickwork at all levels; (3) the condition of the combustion chambers; and (4) any other peculiar features should be obtained. The result of the work should be to assess the chief factors causing decreased durability. The Association has concerned itself with this aspect of the work, and progress in the elucidation of the main sources of trouble has been made. One important feature has been the emphasis given to the different effects encountered at different zones of an installation. The recognition and study of these zonal effects is of the greatest importance in the determination of the factors influencing the durability of the refractory materials.

However, a " brick-to-brick " examination of a retort setting, followed by laboratory examination of samples, needs amplifying data in the assessment of troubles. Complete knowledge of (1) the history of the working of the setting; (2) the limitations in the properties of the refractory materials under general carbonizing conditions; (3) the individuality of the carbonizing unit; (4) the probable local peculiarities in operation; and (5) the nature and influence of the coal used, is very desirable.

Silica vertical retorts show a number of troubles. These include (1) flaking; (2) spalling; (3) erosion and slag attack; and (4) behaviour of cement in the joints. Space will not allow of a discussion of all these troubles, but the reader is referred to papers on the subject by the present author, published in one of the Bulletins of the B.R.R.A. and in the Transactions of the Institution of Gas Engineers (1931). A few observations on " flaking," however, will not be out of place.

During the scurfing operation, surface disintegration, generally at positions in the upper half of vertical retorts, often takes place, pieces of the refractory coming off with the scurf. There can be little doubt that where scurf is burned off by the admission of air, localized high temperatures owing to the rapid combustion of the carbonaceous matter may result, following which there may be a fairly rapid cooling effect. The surface in contact with the scurf has probably been weakened at definite planes by (*a*) depositions and impregnations; (*b*) constitutional changes in the silica in the surface layers resulting from previous high-temperature scurfings; and (*c*) a general spalling tendency of silica products.

Thus, it seems that the influence of such periodic high temperatures, besides embrittling the surface, may easily disintegrate an already-weakened material. The surface of the retort at the flaking zone is not equally affected. Those portions of the retorts adjoining tiles, or which are otherwise supported, do not show the trouble to the same degree as those which bound the combustion chamber. Again, certain retorts in the setting, by reason of their position, receive a lower and less variable flue temperature. These do not show the trouble to the same extent. These observations point to the fact that the combustion chamber temperature and its possible variability, although not necessarily the direct cause, have an influence on flaking.

The properties of the scurf itself have received little attention. There can be little doubt that the extent of the adhesion of this substance to the refractory, together with the amount of its thermal expansion or contraction during the operation of the retort, particularly scurfing, play some part in the disintegration of the refractory surface. Experience with different retorts carbonizing different coals suggests very strongly that the nature of the scurf varies considerably with the coal used and the carbonizing conditions chiefly including temperature. For instance, the tenacity with which the scurf is held to the surface varies very much in different settings. It is also possible that the thermal volume changes of the scurf also vary with its nature. It would seem, then, that the phenomena associated with the formation and rate of growth of scurf require careful definition. Finally, it is probable that some variation in the method of scurfing may reduce the flaking of retorts.

As already stated, the durability of refractory materials in gas-making plants is very often limited by the influence of (1) slags and slag-forming substances, or (2) depositions within the body of the material, which do not necessarily form slags. This latter class of disintegrating agent is not always appreciated in the assessment of the cause of a failure. As illustration, in gas producers it has sometimes been observed that the lining material at certain zones of comparatively low temperature has been disintegrated into powder form or badly cracked in a peculiar manner. An examination of the fragmentary remains may show them to contain appreciable quantities of carbon. It would appear that this carbon has been deposited at certain spots in the body of the firebrick and that this deposition has eventually resulted in the observed description. Observations have shown that the carbon in such disintegrated products has been obtained from carbon monoxide. Actually it is well known that this gas can be decomposed into carbon dioxide and carbon in the presence of certain substances at temperatures approximately ranging from 350°-650°. A considerable amount of experimental work on this subject has indicated that particular types of " iron spots " in firebricks cause the breakdown of the monoxide and the deposition of carbon as " nests " in the vicinity of the spots. This deposition introduces a strain sufficient to cause the disruption of the product. As the result of recent work, the nature of the ferruginous material giving rise to this deposition has received some definition.

There are a number of other very interesting aspects of refractory materials in relation to gas-making, which have occupied or are still occupying the attention of the Association. Unfortunately, the paper is becoming too long, so that I must dismiss them in a line. These researches include work on (*a*) corrosion and erosion; (*b*) the effect of alkali vapours on refractory materials; (*c*) jointing cements; (*d*) the hot-patching of retorts; (*e*) the influence of oxidizing

and reducing atmospheres on the durability; (*f*) the spalling of refractory materials, &c.

Researches of Indirect Interest to the Gas Industry.

The selection of the investigations, which I have very briefly reviewed, has been directed towards showing that the user of refractory materials is continually reaping the reward of research progress. Much other work, however, has been directed towards helping the manufacturer, and I propose, in a few words, to outline the character of some of these investigations.

For instance, a considerable amount of time and energy has been devoted to the study of the firing operation. Efforts have been made to establish fundamentals in the place of the old-time empiricism. Much information concerning (1) the construction, operation, thermal aspects, and efficiency of various firing systems, and (2) the firing properties of fireclay and silica bricks has been obtained. A study of the drying of clays has been on the research programme for a considerable time. Like most problems in clay technology, it is very complex, requiring so many different lines of attack before anything definite or useful can be brought forward. From one angle it is required to find the most efficient, safest, and fastest means of drying large blocks. Naturally such terms of reference open up the whole field of drying technology, with the result that a number of contributions to the study of drying have already been made.

Plasticity or workability, one of the most important properties of clay, is perhaps the least understood. Many investigators have sought a satisfactory analysis of this property, or, rather, combination of properties, with the object of obtaining a quantitative basis for its measurement. In this connection, the Association has studied the mechanical properties of plastic clay by means of a special apparatus, and valuable data have resulted.

The manufacture and properties of highly grogged bricks, chrome-silica, sillimanite, and diaspore products, together with other special refractory materials, form part of the research programme.

Conclusion.

It has been my object in this very inadequate sketch to indicate the work of the British Refractories Research Association and the Joint Sub-Committee in helping on the job of creating a basis for the appreciation of the manufacture and use of refractory materials. The stimulating effect of this work cannot be over-emphasized.

In this connection the comments of Sir Frank Smith, Secretary of the Department of Scientific and Industrial Research, are apposite. Referring to industrial research generally, he says that one of the most useful results observed is the stimulus given to the utilization of scientific methods in the control of industrial operations. Everywhere the scientific method is being substituted for rule-of-thumb; closer control and uniformity are being obtained thereby. It is clear that our progress to-day must be in proportion to our application of the unsentimental thoroughness of scientific research.

Discussion.

The President, opening the discussion, said they were indebted to Mr. Green (who was the Assistant Director of Research of the British Refractories Research Association under Dr. Mellor, who was well known both in this country and abroad), for the brilliant exposition which he had given them of what was being done by the British Refractories Research Association in connection with the scientific study and treatment of refractories in manufacture and in service. There was ample indication that an immense amount of painstaking work had been done by men well-known to them in the Industry, and among them he counted the assistants in the laboratories. They had tackled complicated problems, and had found a practical solution by producing more perfect and more suitable refractories, which formed so important a part of the equipment of the Gas Industry. Indeed, so high had the efficiency been brought that the importation of refractories had become unnecessary, and the trade in this country had been correspondingly increased.

Dr. J. T. Dunn (Newcastle) said he wished to express his admiration for the way in which Mr. Green had put into so small a compass all that he had conveyed in his paper. He could not himself look at the subject from the angle of the Gas Industry, but he thought they would all be glad to think that the Gas Industry, along with the manufacturers of refractories, had taken up the question of research work, when they realized what was being achieved as shown by Mr. Green's paper. No individual firm or undertaking could have accomplished anything like as much as had been done by the British Refractories Research Association, or on as large a scale. The paper teemed with important points, but he would refer only to two. The first was the difficulty to be overcome in and the skill needed to construct apparatus for the purpose of undertaking the necessary research. It meant dealing almost exclusively with work carried on at high temperatures. It was necessary to have for the furnaces something which would still stand at temperatures which had caused the other refractories to give way. His second point was the relationship between pure science and industry. When he began his career many years ago now, pure science was looked upon as one thing, and applied science in industry as another. That time had passed, and now the two went together and helped one another. The chemist had learnt more from industrial research than if he had had to depend on himself alone. To-day, science was helping industry, and industry was helping science.

Mr. A. H. Middleton (Consett) said the subject was one of interest to every engineer engaged in the carbonization of coal, and as a brick manufacturer and a member of Council of the British Refractories Research Association, he congratulated Mr. Green on the very able and interesting manner in which he had tackled his subject. He had succeeded in whetting their appetite for a deeper knowledge on this subject. Mr. Green's work bristled with points and ideas. The author had touched upon the question of specifications, and he (the speaker) could say, as a manufacturer, that he did not agree with putting too much into specifications and making them too rigid. Mr. Green had given a great deal of attention to the under-load test. He had had a word or two with Mr. Green before the meeting, and he mentioned that he still had two years' work before him before he got it to the all embracing stage, so they would understand the difficulties of it. In the under-load test they found different workers working in different ways, which gave a different rate of heating, and there were different ways of reading the results, which made differences of sometimes between 30° to 40°. These differences were apparent on comparing notes for different apparatus in use in this country and abroad, and they were matters which Dr. Mellor and Mr. Green had under attention. As to silica, there was no getting away from its value as a refractory, and he was pleased that Mr. Green had drawn the attention of the younger members to the subject. Speaking as a manufacturer, he was really beginning to get concerned at the extremely long life they were getting now from silica. It looked as though it was going to produce another problem. [Laughter.] It was 9½ years since they introduced silica at their own coke works, and it was still in an excellent state. Looking at this, and considering what Mr. Green and his assistants wished to accomplish, it looked as though, by the time they had finished, the manufacturers would be going out of business altogether. [Laughter.] He wished to take the opportunity of expressing his appreciation of the example which the Gas Industry, the British Refractories Research Association, and the Northern Coke Research Committee had set to all other industries by the research that was being carried on.

Mr. Green, replying, said that he was indebted to Mr. Middleton for having indicated the difficulties of arriving at a simple test for refractories under load and the difficulty of obtaining control of the whole test so that results in different parts of the country, and of the world, would agree. As to silica brick, he could say from his own experience of 13 or 14 years, that it was a really top-hole product. He had carried out experiments on modern silica as compared with that of 14 or 15 years ago, and it had been improved out of all recognition. If they could continue to improve the quality, then they would extend the uses to which it could be put. He quite agreed with Dr. Dunn in his remarks on the reaction of science to industry and industry to science.

Preparation and Sale of Gas Coke

By T. Hornby, Hessle.

[A Paper before the North of England Gas Managers' Association.]

When the Secretary asked me to write a paper and present it at the Annual Meeting, my thoughts turned to a paper read before this Association in 1932.

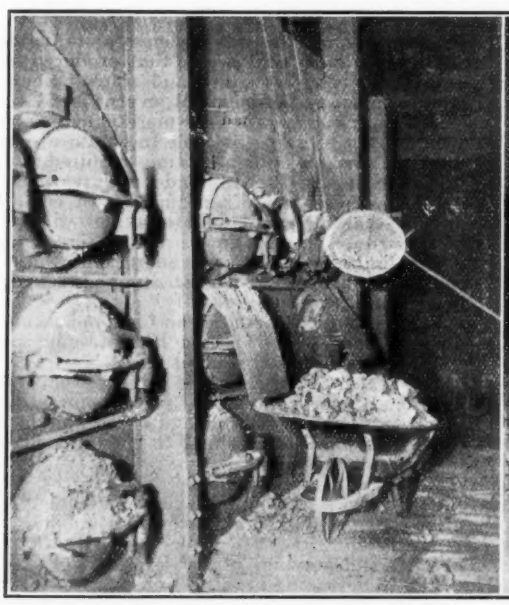
The writer of the paper expressed grave doubts about the future of the gas coke market in competition with the well-graded coke supplied by coke ovens. He believed this competition would be more acute when industry once more resumed normal conditions. I think it was clear, from the discussion on this point which followed, that many members had quite the opposite view. This suggested to me that it was a subject which would be of interest, especially to members in charge of the smaller undertakings.

When I took up my duties at Hessle in December, 1914, I found the coke stock much larger than I had been accustomed to. The price was very low and the method of selling very primitive. Coke was sold at 5d. per sack. It was surprising the size of sack brought by small boys, mostly large flour sacks or two potato sacks sewn together. When on one occasion I saw a hefty railway worker struggling with a bed-tick full of coke, which must have contained over 2 cwt., I had to draw the line.

Dealers paid 8s. for 20 sacks; these were assumed to weigh one ton. It was obvious to me the weight would be considerably more, so I arranged for all cart loads to be weighed over the public weighbridge. I obtained a 2-cwt. scoop weigh scale and commenced to sell at 5d. per cwt. I lost a good many customers, as they did not like the weighing. Early in 1915 we installed a weighbridge.

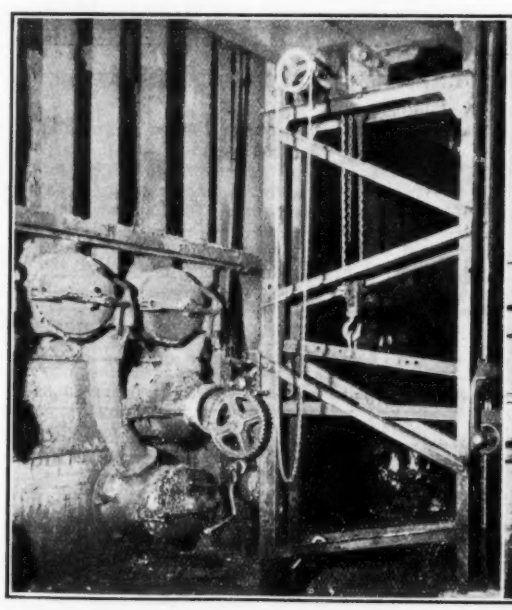
At this stage I think it will be as well if I give a brief description of the carbonizing plant as I found it. There were two retort houses, known as the Old House and New House. The Old House stands with gable ends facing east and west respectively, with the railway siding running alongside its north wall. This house contained one bench of six arches, having seven retorts in each of D section 21 in. by 15 in. by 8 ft. 3 in. long. These settings were derelict.

The New House stands with gable ends facing north and

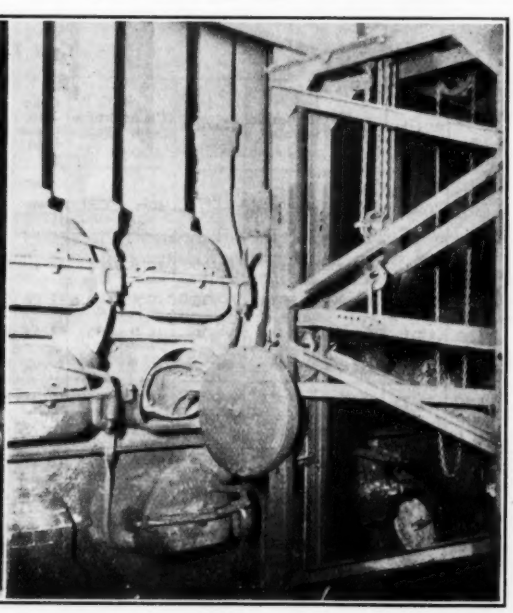


Discharge End, Old Retort House.

Discharge End, New Retort House.



Charging Side, Old Retort House, showing Manual Discharging Machine.



Charging Side, New Retort House, showing Manual Discharging Machine.

south, the east wall being parallel with the gable end of the Old House; a broad passage separates the two houses.

In this New House there was in action a bench of four arches, having eight retorts in each arch of D section 21 in. by 15 in. by 10 ft. long, stop ends. They were heated by separate furnaces on the semi-deep regenerative system. These settings were in a disgraceful condition, having been shattered by an explosion at some time. No reasonable carbonizing temperature could be maintained.

The carbonizing plant as it is to-day consists of the following:

Old House.—One bench having two arches containing seven through retorts in each arch of oval section 21 in. by 15 in. by 11 ft. 3 in. long. These settings are of the shallow regenerative type, heated by two external producers built one at each end of the bench. Only one producer is used at a time to heat the two settings.

New House.—The original bench with arches extended, containing eight through retorts in each arch of oval section 21 in. by 15 in. by 12 ft. 3 in. long. The retorts in both houses are charged by hand, the coke being discharged by separate manual discharging machines.

We have also a carburetted water gas plant of 175,000 c.ft. daily capacity.

Many of my gas engineering friends have questioned the advisability of using oval retorts, considering it a retrograde step, they themselves preferring retorts of D section.

In my opinion the oval retort is equal to the D section for gas production, makes less breeze, and is particularly adapted for the working of the manual discharger.

I have extracted from our books the total breeze made for sale when we used hand rakes only, during the years 1915 and 1916, and find it was 3%. During these years no coke breaking and grading was attempted.

For the years 1931 and 1932, since we installed our present coke breaking plant, the percentage of breeze accounted for has risen to 6% on coke sold. This means that the breeze made by breaking 1122 tons of coke is 9%.

We work our retorts at sufficient temperature to ensure a 4 cwt. charge of coal being properly carbonized in six hours, the retorts themselves being kept under a very slight pressure.

Choice of Coal.

For nearly half-a-century my Company had bought one of the best South Yorkshire silkstone screened coals. During the war this coal was diverted to south country undertakings, and we had to draw our supplies from other sources.

During the coal strike of 1926 supplies were obtained from America, the Continent, and English coalfields. Some of these coals consisted of colliery washery settlings, outcrop seams, lignite, nuts, slacks—in fact, anything that was black. The laboratory tests showed some interesting results, as also did the carbonizing workings.

Some of the coal used produced good gas-making results and coke of good appearance. The American coal gave good gas-making results, with fine-looking coke, but when used in the water gas plant made a very hard clinker, and after 48 hours' working built up so much that we had to shut down the plant and cut the slag off the generator walls.

No. 1.—*Coal Analysis*—1926.

No.	Class of Coal.	Moisture.	Fixed Carbon.	Ash and Sulphur.	Volatile.
		%	%	%	%
1	American (*ex* Charlburg) .	5·2	57·3	11·3	26·2
2	American—Westmorland .	3·4	63·0	8·0	25·6
3	Kanawha screened . . .	4·01	59·92	7·98	28·08
4	Czecho-Slovakian nuts. .	3·99	37·48	3·52	55·01
5	Ostrau washed smalls . .	12·9	63·1	8·1	15·9
6	Silesian nuts.	3·99	58·65	6·66	30·70
7	Large Silesian	2·2	60·0	9·1	28 7
8	Bavarian nuts	11·9	38·1	10·3	39·7
9	Low Laithes washery settlings	14·8	40·7	29·2	15·3
10	Carlton Main washery settlings	16·2	56 8	9·4	17 6
11	Clay Cross	5·4	57·1	12·9	24·6
12	Bolsover 2 in. nuts . . .	1·6	56·6	5·7	36·1
13	Clipstone 2 in. nuts. . .	5·9	56·5	3·6	34·0
14	Silkstone outcrop slacks .	19·0	41·2	7·8	32·0
15	Barnsley outcrop slacks .	14·0	63·8	5·2	17·0
16	Silverhill screened . . .	5·0	58·6	2·4	34·0

One parcel of Continental coal, Ostrau Washed Smalls taken as an example, was pulverized to small granules and washed.

Moisture	12·9%
Fixed carbon	63·1 ,,
Ash and sulphur	8·1 ,,
Volatile	15·9 ,,

The resultant coke was of dense, close texture, and similar in appearance and size to that produced at coke ovens, and, though heavy in ash and sulphur content, gave no trouble in the water gas plant or producers.

Much has been written by more able pens than mine respecting the blending of coals to obtain a coke suitable to meet the very exacting conditions required to-day, but from the experiments I have made with various mixtures of screened slacks and other qualities of coal, I am of the opinion that the smaller undertakings will get more satisfactory results from a good brand of screened coal.

The limited laboratory resources in works of the size such as I have in my charge cannot be expected to carry out research work successfully.

Buyers to-day demand clean fuel, and I know that one of my customers tests all fuel bought, and soon complains when he finds the ash content up.

The coal received from the colliery from whom my Company had bought for a long period showed a varying and increasing amount of ash, and as no appreciable improvement was made I determined to find, and succeeded in finding, much cleaner coals.

In my opinion many unsuitable coals are bought because the first cost is low, no consideration being given to the low price which the resultant coke will command in the market. Furthermore, this class of fuel depresses the price of neighbouring undertakings who strive to make a first-class coke.

The Undertaking in my charge is within five miles of the port of Hull, where large shipments of coke are made, and any surplus unshipped coke is sold inland.

Before buying our requirements for a period, we obtain 50-60 ton lots of coal; samples of the whole are taken and

Coal Tests—1928.

No.	Price.	Weight.	Make.	Calorific Value.	Therms.	Coke Sold.	Breeze Sold.	Coke and Breeze Sold.	Value. Coke.	Value. Breeze	Value. Coke and Breeze.	Net Cost. Coal.	Cost. Therm	Analysis, %.			
		Tons.	C.Ft.	B.Th.U.	Per Ton.	Cwt.	Cwt.	Cwt.	At 22s.	At 6s.			Pence.	Moisture.	Volatile.	Fixed Carbon.	Ash and Sulphur.
	s. d.								s. d.	d.	s. d.	s. d.					
1	20 6	52·15	666,000	515	65·76	10·9	0·5	11·4	11 11·88	1·8	12 1·68	8 4·32	1·525	1·015	30·485	63·03	5·47
2	20 6	39·6	519,200	509	66·73	10·45	0·61	11·06	11 5·94	2·196	11 8·13	8 9·86	1·586	1·15	30·94	62·51	5·4
3	20 3	17·1	207,800	500	60·76	11·0	0·52	11·52	12 1·2	1·872	12 3·072	7 11·92	1·578	1·53	27·68	62·21	8·58
4	19 10	34·35	457,400	500	66·575	10·3	0·63	10·93	11 3·96	1·872	11 5·832	8 4·168	1·504	1·12	28·36	62·81	7·71
5	19 10	34·75	454,900	508	66·49	10·35	0·59	10·94	11 4·62	2·124	11 6·744	8 3·256	1·492	1·21	27·9	62·79	8·1
6	19 6	34·7	457,600	501	66·06	10·1	0·68	10·78	11 1·32	2·448	11 3·768	8 2·232	1·485	1·01	28·96	60·4	9·63
7	19 10	39·55	536,800	526·9	71·51	10·01	0·43	10·44	11 0·132	1·548	11 1 680	8 8·32	1·458	1·36	30·11	62 64	5·89
8	20 5	30·5	412,400	512	69·68	9·91	0·52	10·43	10 10·812	1·872	11 0·6	9 4·316	1·611	1·24	29·98	66·08	2·7
9	20 4	16·05	218,600	517·5	70·475	10·77	0·43	11·20	11 10·164	1·548	11 11·712	8 4·228	1·422	1·16	28·86	67·58	2·4
10	19 11	10·85	144,500	500	66·59	8·68	0·36	9·04	9 6·576	1·296	9 7·872	9 5·128	1·698	4·1	33·1	58·9	3·9

Remarks: Nos. 1 and 2—Coke of good quality. Burns in producer well. Forms no clinker. No. 3—Coke formed heavy clinker in producers. Stopped test. Nos. 4 and 5—Coke good. Clinkers very slightly in producers. No. 6—Coke of fair quality only. Heavy clinker formed in producers Nos. 7, 8, and 9—Coke good quality. Light, and burns very freely in producers. No clinker. No. 10—Coke soft and spongy, light. No clinker.

XUM

tested in the laboratory at the same time as we carbonize. The joint results are tabulated, characteristics of coke noted, and a valuation table made out as on previous page.

I am now able to select and buy coal which has been proved by subsequent tests, which are constantly being made, to be reasonably constant in its results, and have bought under contract, having penalty clause for any excess ash over 5%, and I never had to make a complaint. The average of tests made in the laboratory during the period of this contract was:

Moisture	1·29%
Ash and sulphur	3·96 ,,
Volatile	28·99 ,,
Fixed carbon	65·76 ,,

As I have mentioned previously, the stock of coke was higher than that to which I had been accustomed, and I had quickly to get into action.

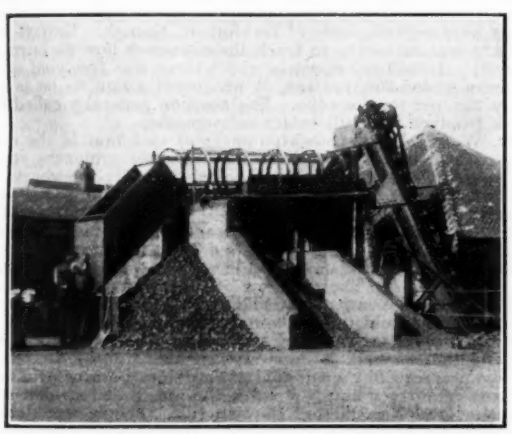
Expanding the Coke Market.

The sales had more or less been handled by dealers who were more concerned with selling coal than clearing my coke. Being a newcomer, I did not know the possible users, so I had to rely on a local directory for names, and after the usual office hours spent many long nights in addressing my appeals to the names extracted.

However, I soon found a noticeable increase in inquiries, and my first success was obtaining a contract for 150 tons per annum at an increased price, and I soon obtained as many customers as I could supply at 12s. per ton—a very pleasing advance.

Later, I saw that the coke oven owners were invading the market and offering sized and graded coke. I was approached for broken coke and commenced to break coke with hand beaters. This was a costly proceeding, the labour cost and breeze made being excessive.

In the year 1926, I purchased a small coke breaker with a spare set of cutters for £19, and fixed it in front of the pump house, driving it by means of a belt from the line shaft.



Coke Screening Plant, East Side.

After experimenting, I bought a second-hand 8-h.p. gas engine and fixed the breaker in the coke yard.

Making further experiments with this breaker and a small manual rotary screen, the demand for graded coke grew and, though uneconomical, it kept my customers with me.

In October, 1929, I obtained sanction to purchase a 15 ft. by 3 ft. rotary screen with elevator, and adapted the existing breaker to this, driving the whole set with the 8-h.p. gas engine. The screen was divided into two sections of $\frac{3}{8}$ in. and $1\frac{1}{4}$ in., the first taking out the breeze, the second $1\frac{1}{4}$ in. coke, and 2 in. coke discharged at the end. This allowed a good proportion of nutty coke to come away with the breeze. We then put a $\frac{3}{8}$ in. mesh in the first 5 ft.; this takes the fine breeze out and allows the $\frac{5}{8}$ in. nutty coke to come down separated.

The cost of this plant as fixed in 1929 was:

	£	s.	d.
Elevator and screen	153	10	0
Shaft, pulleys, belting, &c.	39	14	5
Coke breaker	19	0	0
Gas engine	9	10	0
Labour, erecting	91	6	11
	£313	1	4

The breaker is fixed in a concrete pit, below ground level, covered in with steel chequer plates and provided with chute so that the coke can be shot straight from the barrows or thrown with shovels from a heap to the breaker-rolls.

The original breaker was too light in construction and was constantly undergoing repairs, so a more robust breaker was fixed in 1931. The capacity of the present plant is rated at 10 tons per hour.

From October, 1929, to March 31, 1933, the total cost of renewals and repairs is as given below:

	£	s.	d.
New breaker	68	0	0
Renewals and repairs	203	2	1
	£271	2	1

This includes the cost of providing a small hopper to facilitate filling bags, one extra chute, additional wall and extra fencing, additional floor plates, and altering the breaker pit, which amounted to £79, which will not be a recurring yearly charge, so that we can take the repairs only to be approximately near to £124, for the $2\frac{1}{2}$ years, or at the rate of £50 per annum.

Taking the cost of the original plant, £313 1s. 4d., and adding the cost of the new breaker and other additions, £115 16s. 7d., the total works out at £428 17s. 11d.

To arrive at a charge against the plant I take our average interest charge as $7\frac{1}{2}$% per annum.

		£	s.	d.
$7\frac{1}{2}$% interest on £428 17s. 11d.	=	32	3	3
Wear and tear	=	50	0	0
Renewal, 10 years' life	=	42	17	9
	= £	125	1	0

To this must be added the cost of labour, gas used by the engine, and oils and grease.

	d.
Labour per ton, breaking	3·06
Gas per ton, 31 c.ft.	0·50
Oils and grease	
	3·56

The quantity of coke put through the breaker and screening plant in 1932 was 1122 tons, and the resultant percentage sizes recovered, together with near approximate values, is given below:

		£	s.	d.
Fine breeze	= 9% at 6s. 2d. per ton, works	0	0	6·66
$\frac{3}{8}$ in. nuts	= 10% at 17s. ,, ,,	0	1	8·04
2 in. and $1\frac{1}{4}$ in. nuts	= 81% at 26s. 6d. ,, ,,	1	1	5·58
		£1	3	8·28

Taking the standing charge of £125 1s. 0d. per annum divided by tonnage through the plant, the cost of grading is 2s. 2·74d. To this must be added the labour and other costs per ton, which are 3·56d., making a total cost per ton of 2s. 6·3d.

A test over one hour was recently made with one man feeding the breaker, and the various sizes from under the screens were weighed and found as given below:

Tons.	Cwt.	Qrs.		
2	4	3	of 2 in. size	= 54·9%
1	2	2	of $1\frac{1}{4}$ in. size	= 27·6 ,,
0	6	1	of $\frac{3}{8}$ in. size	= 7·7 ,,
0	8	0	of fine breeze	= 9·8 ,,
4	1	2		

The labour cost	= 3·06d. per ton
Gas, 31 c.ft.	= 0·50d. ,,
Oils and grease, estimated	
	3·56d. ,,

On the face of it this does not seem a very good proposition, but in view of the fact that I have several times had to dispose of surplus large coke at prices netting 15s. at the works, and the probability that this would have to be done in the future and at lower prices, led to the purchase of the plant. With increased demand for broken coke the overhead charge per ton handled will diminish.

The total coke and breeze sold during the past two years is given below:

—	1931.	1932.
	Tons.	Tons.
Large unbroken coke	1341	1358
2 in. broken coke	531	539
$1\frac{1}{4}$ in. ,,	323	370
$\frac{3}{8}$ in. ,,	111	113
Fine breeze	133	140
	2439	2520

I think it is generally an accepted fact that most gas undertakings obtain prices for coke about 2s. per ton below

the cost of coal carbonized. Below I give a table showing the cost of coal and price per ton received for coke:

—	Cost of Coal per Ton into Retort House.	Net Price Realized per Ton for Coke.
	s. d.	s. d.
1928	22 7½	18 5¼
1929	21 10¼	18 10¼
1930	22 3¼	19 10¼
1931	22 3¼	21 6
1932	21 0¼	21 2½

The yard prices are as follows:

Breeze	4s 6d to 9s. per ton *ex* works
⅜ in. nuts	16s. 6d. ,, ,,
1¼ in. coke	26s. 6d. ,, ,,
2 in. coke	26s. 6d. ,, ,,
Large unbroken	25s 0d. ,, ,,

The fine breeze is sold for concrete block making chiefly; the ⅜ in. nuts I have sold by contract for the past two years at the price given in the table. 1¼ in. size is sold for domestic use and small central heating units, the 2 in. for large central heating units, and the large coke is sold to steam raising plants, laundries, and bakeries.

Our own motor delivers, daily, anywhere inside our area of supply, the extra charge being at the rate of 3s. 6d. per ton on lots of 5 cwt. or over.

We send out at intervals printed leaflets giving the current prices; special circulars are sent to large customers, and our collectors and fitters book orders. The canvasser also seeks out orders, while at intervals one of the slot meter collectors makes special calls, soliciting orders, and now we are getting a steady domestic trade among the working class, who take one or two bags weekly. These bags contain 6 stones of either size of broken coke, as desired, and are delivered at 1s. 3d. per bag.

Samples of all sizes are exhibited in our showrooms. In the winter of 1931 we obtained a supply of strong paper bags to hold 2 stones of broken coke. These bags have the Company's name printed on one side and are sold at the showrooms at 7½d. each. The bags cost us 1·26d. each. Only a small quantity is sold each week, but each one sold is a good advertisement.

I tried to induce shop-keepers to stock these bags, offering a very liberal discount, but the general feeling was that their errand boys would have to deliver them, and they had as much as they could do to take out groceries, &c.

Wherever a person is doubtful as to the use of coke we send a 2-stone paper bag free.

Local dealers are allowed a discount of 1s. 6d. per ton off the current works price.

Quite recently I purchased from a South Yorkshire Colliery some 20 tons of oven coke made from washed slacks. The ash and sulphur content was over 17%. This coke was used in the producers and was exceedingly troublesome.

From tests made during last March the average ash and moisture content of our coke, delivered to the breaker, was: Ash 5·32%, moisture 0·95%.

At the recent Joint Gas Conference at Birmingham, mixed views regarding the future of the Gas Industry were put forth, one section being all out for an all-gas industry, while another section took the view that gas and coke are inseparable.

We must face facts. We cannot scrap our present methods, and for the moment we must do the best we can with both commodities, never failing to meet gradually the changing needs.

In conclusion, I feel sure that when industry revives both manufacturers and domestic users will more freely buy gas coke, and, provided it is supplied properly sized, of low ash content, and quenched properly, we shall hold the market against coke from colliery ovens.

Discussion.

The PRESIDENT said there was only one item which he thought was perhaps somewhat out-of-date, and that was the rotary screen, which was inclined to make more breeze than those screens where the coke travelled over the meshes. He had seen Mr. Hornby's plant, and for a comparatively inexpensive plant it met the situation extremely well. He had certainly given much consideration to his own particular needs.

Mr. R. H. DUXBURY (South Bank) said that in his paper read before them in 1932 he expressed some doubt as to the future of gas coke in competition with graded coke supplied by ovens, and he had said that he believed that that competition would grow more acute as industry revived. His opinion was still the same. As the years progressed, they would find it more and more necessary to make gas and not coke. Mr. Hornby said he believed in using a good screened coal. There would be a difference of opinion about that. Some believed in using good and other inferior classes. Mr. Hornby was favourably placed and without competition. He was getting 21s. 6d. for 81% of his coke, and many large, and a considerable number of smaller, undertakings would, he thought, be very glad to get anything like that figure. With competition, he doubted whether he would get that price. He knew cases where a good screening plant was used and the price was not more than 17s. 6d., which he thought was a good average to-day. In his own district, good coke from good washed coal was obtainable delivered at 18s. a ton. Mr. Hornby quoted 25s. for large unbroken coke. In the South Bank district, that price would be useless.

The author was to be complimented in getting an ash content in his coke of only 5·32%. He (the speaker) did not agree with Mr. Hornby in his concluding remarks, when he said that when industry revived both manufacturers and domestic users would buy gas coke more freely, and, provided it was supplied properly sized, of low ash content, and quenched properly, they would hold the market against coke from colliery ovens. If trade conditions improved, then he thought that coal would be reduced in price and the domestic user would be inclined to buy coal, and if industry revived they would see the coke ovens turning out coke in enormous amounts with the effect that the gas coke business would be swamped. Instead of getting 18s., it would be much less than that.

Mr. J. R. BRADSHAW (Hartlepool) said that he had installed a rotary screen within the last six months. It made breeze, of course, but then he preferred to remove the breeze on his own premises rather than let the customer be troubled with it. The rotary screen made no more breeze than the shaking which the coke might get from handling in other directions. The discussion seemed to revolve round whether they were going to be coke suppliers or not. He disagreed with Mr. Duxbury on that point. It was his opinion that the Gas Industry should be suppliers of light, heat, power, fuel, and anything else that to-day was connected with the carbonization of coal. It was their business to take coal from the pits and treat it scientifically. Indeed, he thought that if the Association had foreseen in the early days the future of electricity, they might have been suppliers of electricity also. They must keep on selling smokeless fuel and provide for the consumers' needs; and it really did not matter very much whether they supplied him with gas or coke so long as they were supplying him. The time was rapidly coming when coke would be properly sized, broken, and cleaned. They did not expect the consumer to put up with anything inefficient in gas, and they should not ask him to tolerate inefficiency in solid fuel. There would always be the difficulty of coke having to be sold at a low price, he thought. There were several ways of tackling it, though. Expert salesmanship was necessary to teach the consumer how to burn coke properly. In colliery districts where there was free coal or coal at prices under 20s. per ton, it was never going to be possible to get 26s. per ton for coke. The position generally called for a better product and still better salesmanship.

Mr. W. W. ATLEY (Stockton-on-Tees) said that in the rotary screen which he had laid down about eighteen months ago, he got very little breeze. He had listened to Mr. Duxbury with interest, and was wondering whether Mr. Duxbury was a gas engineer or a coke oven manager. [Laughter.] One way of getting over the difficulty of low coke prices and competition, he thought, might be attained by some arrangement among producers in a district for the sale of coke. It would be better for all concerned. The dumping of coke from one district into another created competition and was a vicious circle, and in the long run would only rebound against those who took part in it. It would be better if they could all co-operate. As to the selection of coal, he agreed with Mr. Hornby that it was an advantage to buy good coal rather than inferior grades, for when it came to selling the coke, the amount of clinker in the domestic grades would tell its own tale. People would buy it once or twice, but not a third time. If coke sales were properly organized, there should be no need to ask the customer to take a second lot: he would come to them and ask for it.

Mr. A. H. MIDDLETON remarked that from his point of view he quite agreed with Mr. Duxbury. [Laughter.] They had to remember, however, that two industries were making coke, and they had to get rid of it. What they must do was to make the fuel as attractive as possible and increase its uses, and do everything in the way of research on stoves and different ways of burning it, as, indeed, some of the larger gas companies in London and the provinces were doing. As to export for those undertakings near the sea, he did not think there was a great deal of scope in that direction. At his own works, they had 20,000 tons which ought to have been exported this season. The export market was equally as difficult as the home market, and until the heavy industries revived and could use more of their own products, there was going to be an excess on the market. He had experience of both vibratory and rotary screens. The rotary screen took up rather a lot of room, but he did not say anything against it. Where coke was weak enough to be broken, it was better that it should be broken in the works. In his own case, they were out to market it in the most perfect manner possible, and sometimes it was re-screened.

AUTHOR'S REPLY.

Mr. HORNBY, replying to the discussion, said that, as to the rotary or vibrating screen, had the President considered the question of cost of the latter? He had been impressed by the work of the vibrating screen, but he could not spend the money. Discussing Mr. Duxbury's remarks, Mr. Hornby said that they must change with the times, but the times did not warrant a change from dual gas and coke to complete gas. They had heard a lot about gas for central heating at 2d. per

therm, but if large works were finding it difficult to sell gas for central heating at that price profitably, then it was going to be hard for small undertakings. He had no difficulty in buying coal with less than 5% ash content, and the figures which he submitted were those of an aggregate test over the past twelve months. He knew of one Yorkshire colliery where coke was being sold at 25s. per ton. It was a matter of selling. If they did not go out for business, it would not come to them. His success in his own district was due largely to his sales staff. They went all out to sell coke as well as gas. If Mr. Duxbury lived in an exporting town, he would know what competition was. Export was not the salvation of the trade.

Bombay Gas Company, Ltd.

DIVIDEND MAINTAINED

The Ordinary General Meeting of the Bombay Gas Company, Ltd., was held at the London Offices, Moorgate Station Chambers, E.C. 2, on Friday, May 5—Mr. WILLIAM GRAHAM BRADSHAW, C.B.E. (the Chairman of Directors), presiding.

The SECRETARY (Mr. A. Dickson) read the notice convening the Meeting, together with the report of the Auditors; and the Directors' report and statement of accounts for the year ended Dec. 31, 1932, were taken as read

The Chairman's Address.

The CHAIRMAN, in moving the adoption of the report and accounts, said:

There is very little in the accounts which we lay before you to-day which calls for lengthy comment. The prosperity of the Company, as you are aware, depends in large measure upon the conditions prevailing in India and especially in Bombay. In the early part of last year the situation in Bombay was comparatively quiet, and business could be carried on under more favourable circumstances. Untortunately, when local trading was beginning to show signs of improvement there was an outbreak ot communal rioting and bloodshed of the very worst form which continued from the middle of May to early July, the numbers killed and injured amounting to several hundreds. As a consequence of these outbreaks, business was seriously affected and continued to be so during the two or three months following. The duties of lighting and extinguishing the public lamps were only carried on under the utmost difficulty, the lamplighters having to be accompanied by armed protectors, otherwise the lighting could not have been maintained. Eventually a more normal state of affairs was restored and trading conditions once more resumed. In November a special letter of thanks was received from the Municipal Commissioner for the manner in which our Public Lighting Department had attended to their duties during the riots despite the considerable personal danger to themselves.

The effect of this state of unrest, coupled with the world-wide depression of trade, is reflected in the accounts, but, in spite of the great difficulties that confronted the General Manager and his staff in Bombay during the period under review, the results of the year's trading enables the Directors to recommend the declaration of the same dividend as for the previous year. This, I am sure you will agree, reflects great credit on the whole of the staff and employees, and, of course, specially on the Engineer and Manager in Bombay.

The sale of gas shows only a slight decrease of 121,000 c.ft., or 0·03%, which is mainly due both to large and small consumers economizing their consumption of gas consequent upon the general trade depression. The gas sold for heating purposes was slightly less, but the public lamp consumption showed an increase of nearly 4 million c.ft., or 1·9%, due in the main to longer hours of lighting necessitated by the disturbed state of the city.

The total capital expenditure to the end of 1932 amounts to £389,542, and *is less* by £1124 than at the end of the previous year, the decrease resulting from a credit created by the usual writing down of the book value of meters, cookers, and geysers. We spent on capital account a sum of £980 for the provision of new mains, but the expenditure for meters and stoves has been provided out of revenue. The capital expended per million c.ft. of gas sold remains almost the same at £834. Another mile of additional mains laid during the year brings the total mileage up to 211.

REVENUE ACCOUNT.

Turning to the revenue account, private gas receipts are less by £1568. The revenue from public lamps, after deducting cost of maintenance, is less by £17. The revenue from meters, stoves, and fittings is more by £234.

Coke and breeze produced less by £786 owing to the rate obtained for large coke being rather lower than in 1931. This is due to competition with the Soft Coke Cess Committee, who have opened several depôts in Bombay and the suburbs for the distribution of their coke. The total coke we sold amounted to 11,531 tons. The progress made in the development of the sale of graded or "domestic" coke was such as to enable the clearance of the coke yard without having to operate the blue water gas plant at any time during the year. The average price obtained for coke was 35s. per ton, as against 35s. 11d. the previous year.

JAPANESE COMPETITION.

The receipts from the sale of tar are less by £1975, the average price being 2d. per gallon less than in 1931. The lower price and smaller receipts result from the severe competition of Japanese imported tar, which was, and is being, dumped into Bombay at very low rates. The Japanese have been enabled to do this by reason of the depreciation of the Yen due to the embargo placed on exports of gold from Japan. This resulted in our contract rate for tar being completely undermined, our contractors being unable to dispose of their stocks at the contract rates. It was necessary, therefore, to meet them on the question of price, and in order that the Company's tar could be sold in competition with the Japanese tar, the price to the contractors has been reduced by Rs.27 8 annas per ton, which in sterling is equivalent to a reduction of 41s. 3d. per ton. There has been considerable agitation in Bombay that the Government of India should pass legislation similar to that existing in many other countries for the protection of indigenous or home industries against the dumping of goods into India by countries with depreciated exchanges. The matter formed the subject of a debate in the Legislative Assembly at New Delhi early in this year, when startling revelations were disclosed of the apparently organized invasion of Japanese goods at ruinous prices.

The Times correspondent at Delhi wrote from there on April 12 that the Legislative Assembly had passed that day without a division the Safeguarding of Industries (Ante-Dumping) Bill which empowers the Governor General in Council to impose duties on goods the import of which may endanger the existence of industries established in India.

No steps, however, under the Bill can be taken against Japanese imports until six months hence when, in accordance with the notice, the most favoured nation treatment granted to Japan under the Indo-Japanese Trade Agreement will come to an end. We are hoping that the Company will be relieved by the imposition of a protective tariff on imported Japanese tar from the excessive competition to which it is now subjected.

In total the revenue receipts are less by £4109. On the other side of the revenue account the total expenditure is less by £3772. Coal cost £2416 less than in 1931. The quantity of coal carbonized was 30,686 tons, an increase of 320 tons, and the sale of gas per ton of coal carbonized was 15,215 c.ft., compared with 14,446 c.ft. in 1931, a result which is highly satisfactory.

Repairs and maintenance of works and plant is £514 less. Further progress has been made during the year with the replacement of retort settings of ordinary fireclay material with that of silica and siliceous material. Besides this there have been no additions or alterations of any importance. The works plant and buildings have had the usual careful attention given to them and are reported to be in a satisfactory condition. In total the manufacturing charges are less by £3077. Distribution charges are less by £1313. Of these the repair and renewal of mains and services was more by £1229, while the cost of repair and renewal of meters was £1543 less. The expenditure incurred on fittings account was £955 less.

In the net result of the year's work the balance of profit carried to the net revenue account is £21,994, which is less than the profit of the previous year by £337. There is a profit on exchange of £5790, which is £1142 more than in 1931 owing to larger remittances. Adding this exchange profit and deducting the debit balance of interest, £997, there is a net profit of £26,787 for the year. The undivided profit brought in from the previous year—£39,033—brings the total available profit up to £65,819. Deducting from this the interim dividend of 3½% amounting to £10,500, which was paid in November last, and the additions of interest to the reserve funds, which, together amount to £2400, there remains £52,919, out of which a final dividend of 4½% is recommended, making 8% for the year. The final dividend amounts to £13,500, and leaves £39,419 to be carried forward, which is £386 more than was brought in from the previous year.

THE FUTURE.

With regard to the future, I will not attempt to prophesy. It is wiser to content myself with stating briefly the present position and to leave you to form your own conclusions.

As regards the general state of affairs in India, the outlook is very uncertain. No one knows whether the policy of the British Government as outlined in the White Paper will be passed by Parliament and, if it is, what it will lead to. One would be inclined to think that such a tremendous change as is contemplated cannot produce immediately that condition of confidence and political rest which are the essentials of active trade. On the other hand, if the proposal is rejected we must expect fresh disturbances from disappointed politicians, which will be a certain hindrance to commercial enterprise. I venture to express the opinion that the aphorism of the Latin Grammar, which we used laboriously to construe in the days of our youth, has still a useful and safe lesson for the present day, *in media via tutissimus ibis*, and that a more moderate experiment in the sphere of Home Rule would be wiser and less dangerous than the sudden and far-reaching changes proposed. At any rate, in the interests of the Bombay Gas Company I plump for "safety

first " even in face of the bold spirits who loudly declare that such discretion is tinged with pusillanimity.

As far as the Company is concerned, we have no large capital outlay in front of us. The works, I believe, are in excellent condition, for which belief I have the certification of our experienced and able Engineer and General Manager, which is confirmed by the testimony of some officers of other Gas Companies who have visited our works and have expressed their admiration of them. We have made fresh contracts for coals at a favourable price, and we should be accorded in October next the protection of a tariff on Japanese tar.

We are therefore in an excellent position to benefit by any improvement which may take place in the general position in India or to meet and overcome any adverse circumstances which may present themselves, and that in spite of the very heavy burden of increased taxation at home and in India.

We have the advantage of having with us to-day our General Manager, Mr. W. T. Lane, who is home on a well-earned furlough, and I take this opportunity of offering to him a hearty welcome to our council. I shall ask him in acknowledging the vote of thanks, which I am sure you will presently accord to him and the rest of the staff in India and London, to say a few words as to the state of the Company's works, the merits of his staff, and the outlook generally.

The General Manager and Engineer, Mr. Lane, being in England, the Acting Manager, Mr. Boulter, records with regard to present and future prospects that at the present moment the political situation throughout India is more settled than it has been during the last two or three years and is producing a marked effect on business generally, while creating a far greater degree of confidence among traders in Bombay. Provided this improvement is maintained and the dumping of Japanese goods into India is successfully dealt with, Mr. Boulter anticipates still better trading conditions in the future which should undoubtedly benefit the Company by a resultant increase in business.

Mr. Boulter also records the excellent and loyal support the Company has received once again from the staff and workmen during the year and especially during the disturbed period when the communal riots were at their worst. A strong sense of good feeling and co-operation prevails among the staff and employees, combined with a willingness to support the Company even under the most trying conditions.

The CHAIRMAN then moved:

> That the report of the Directors and the statement of accounts for the year ended Dec. 31, 1932, now submitted, be and the same are hereby received and adopted.

The DEPUTY-CHAIRMAN (Mr. H. H. Macleod) formally seconded the resolution.

Capt. W. J. LIBERTY, referring to the Chairman's remarks on the difficulties of lighting the public lamps and the necessity for armed guards for the lamp-lighters, asked if they had considered installing automatic control mechanism.

The CHAIRMAN, in reply, said that the expense involved would probably be prohibitive.

Mr. W. T. LANE further remarked that the automatic control mechanism, so far as he knew, was too delicate for the climatic conditions; and, in any case, it would not economize very much, as it was their policy to clean their lamps daily. There were very few cities in the world, he said, where the public lamps were attended to with such care as in Bombay. The climatic conditions necessitated this; one could visit Bombay any night, and he did not think one would find any lamps which had not been polished. Forty lamps were allotted to each man; they considered that he had sufficient time for these, and he did them. In fact, visitors had taken the trouble to go round the roads—and not only the main roads, but the side roads also—and one and all had commented on the wonderful cleanliness of the street lamps. They had very keen competition, and if they did not do this he did not think they would keep their public lighting. They spared no expense in regard to this matter. During the riots referred to by the Chairman, many of their lamps were smashed beyond recognition, and in some streets there were no lamps left at all.

The resolution for the adoption of the report and accounts was then put to the meeting and carried unanimously.

DIVIDENDS.

The CHAIRMAN thereafter moved:

> That the final dividend for the year ended Dec. 31, 1932, of 4½% (less income-tax at the rate of 2s. 6d. in the £) be now declared payable on and after May 8, 1933, making with the interim dividend of 3½% a dividend of 8% for the year.

Mr. STANLEY H. JONES seconded this resolution, which was unanimously agreed to.

RE-ELECTION OF DIRECTORS AND AUDITORS.

Mr. H. H. MACLEOD moved that the retiring Directors, Mr. William Graham Bradshaw, C.B.E., and Mr. Stanley Hunter Jones, being eligible and offering themselves for re-election, be accordingly re-elected, remarking that to make this proposal carried its own recommendation. In these gentlemen they had a most excellent Chairman and Director.

Mr. A. M. PADDON, in seconding the resolution, said that he took it that the shareholders were satisfied with the results of the year's work in the face of the difficulties described by the Chairman. These gentlemen were not only the trustees of their prosperity but the architects of their future.

The resolution was unanimously carried, and Mr. BRADSHAW briefly returned thanks on behalf of himself and his colleague for this renewal of their confidence.

Mr. F. R. SMITH proposed, and Mr. H. F. HILLS seconded, that Mr. Alfred Morland, F.C.A., and Mr. Frederick John Bradfield be re-appointed Auditors of the Company for the ensuing year at the same remuneration as heretofore.

This was unanimously agreed to, and Mr. BRADFIELD returned thanks, saying that they would continue to do their best to merit the shareholders' confidence.

VOTES OF THANKS.

The CHAIRMAN then moved that the best thanks of the shareholders be given to the Manager and Engineer and staff and employees in India and to Mr. Dickson and the staff in London for their excellent work during the past year. The accounts were eloquent of the work they had done. Their staff in India, including the officers and General Manager, often carried out their work under conditions of considerable danger, and they owed them their gratitude for all they had done so bravely and so successfully during the past year. He did not think they could have a better European staff in India; they were excellent in every way. Their only desire was for the prosperity of the Company, and that desire was fulfilled in spite of the troubles they had to face. He coupled this vote with the names of their Engineer and Manager in India and their Secretary in London.

Mr. A. M. PADDON seconded the vote, which was also heartily supported by Capt. W. J. LIBERTY, who remarked that they heard from time to time of their staff in India. Their District Superintendent had been in this country recently and had done good work in Leicester, while their Public Lighting Superintendent was to give a paper at Margate before the Association of Public Lighting Engineers. So the public lighting of Bombay was recognized even in this country.

Mr. W. T. LANE (Engineer and Manager in Bombay), replying to the vote of thanks, said: It gave me great pleasure to receive an invitation from the Directors to attend the shareholders' meeting. It is an equal pleasure to me to acknowledge on behalf of the officers and staff of the Company on the Bombay side the vote of thanks proposed by our Chairman. Such an expression is very much appreciated by all of us in Bombay, and enables us to feel that, although we are separated by some 6000 odd miles from our Head Office, we are not left out in the cold or forgotten. As your Engineer and General Manager, I can assure you that you are served by a united and loyal staff and workmen—and highly efficient at the same time. They are one and all out to do their best for the good of the Company and assist towards the prosperity of the undertaking. Few concerns run so smoothly and have such a willing body of employees.

During the time I have been your Chief Officer in Bombay I have scarcely known what it is to be worried by difficulties in the way of labour trouble and discontent, and I have yet to find a more cheerful and willing set of workmen than those you employ—who number approximately a thousand. We work together like a happy family and with an air of good fellowship and friendly feeling. For this state of affairs you have to thank the able gentlemen you have appointed as your Directors. Their policy and understanding of the conditions with which we have to deal in Bombay are of the utmost importance, and few of you, perhaps can realize the enormous assistance they are to an officer like myself who very often finds himself called upon to deal with difficult problems. I often envy my colleages in this country who can consult their Chairman and Board at once, instead of having to enter into correspondence; but one satisfaction I have is that I know when I ask for guidance I shall receive the best possible.

WORKS AND DISTRIBUTION SYSTEM.

Again thanks to your Directors, I am able to assure you that you have an excellent works—well laid out and equipped with thoroughly good plant, which is almost self-contained and which is kept in perfect order; again thanks to your Board, whose policy and instructions have been to keep an ever watchful eye on this important matter. You will be pleased to hear that we have no heavy expenditure to face in the way of new plant at present, and also that we are getting very high efficiency from the present plant and are supplying a uniform gas. The distribution system is in excellent order and is being improved and enlarged year by year.

The Directors have during the last few years encouraged the staff in Bombay to give very close attention to the matter of service, and as a result you are able to have the returns you hold in your hands to-day. They have practically spared no expense—the new showroom and offices in the Fort, which were opened on Jan. 1, 1932, are among the best to be found anywhere, being very popular with the public, while they have resulted in our being able to get into close contact with our consumers and prospective ones. In spite of the enormous drop in exports, &c., the world-wide depression in trade, and the dislocation of business that has been caused by political and communal disturbances, riots, and hartals, you will have gathered from the Chairman's speech that we have still been able to maintain our sales of gas, and that in view of the fact that everybody has been obliged to economize and that competition in the form of a well-organized Electric Supply Company has had to be faced, I think you would have had a very different statement of affairs before you to-day if you had not a very able and far-seeing Board to guard your interests and insist on good service.

PUBLIC LIGHTING.

Here again your Board have insisted on the closest possible attention being given to ensure that the Company give the Bombay Municipality the highest efficiency possible. The day prior to leaving Bombay I called on the Municipal Commissioner to ask him if I might inform my Directors whether he

was satisfied with the service given by us to the Municipality or otherwise, and he informed me that we had been carrying out our contract entirely satisfactorily, and he thanked the Company for so doing.

Your Chairman has told you what a difficult year we had to face, and I will not enlarge upon his remarks although I could do so. Japanese competition is nothing more nor less than appalling. The fall of the Yen has hit everybody, and Japanese articles are put on the market at ridiculously low prices. You may be expecting me to give you some idea as to what is happening during this current year. In these times I feel it would be very unwise of me to attempt to prophesy. So far we are keeping pace with last year, and in my private mail of last week I was informed that our Fittings Department have never been so full up with work as at the time of writing. This you may take as a good sign, but new installations cannot immediately make up for the economy that our existing consumers have been obliged to enforce. Your Directors have made most favourable coal contracts for the present year, but against this our residuals markets are suffering badly. Generally speaking, if India, and particularly Bombay, is free from political and communal disturbances and hartals one might be forgiven for being optimistic, and the Company should be able to hold its own. One thing I would like to impress upon you is that this Company can never be accused of exploiting India at the expense of the people of India. I say this because in speeches made by members of the Congress party various firms are accused of bleeding India and exploiting her at the cost of the people. We have not been doing that, and it is a great asset to-day to be able to claim this. We have never extracted from India exorbitant profit. We are absolutely non-political in our views. The Company possess many good Indian friends and consumers, and the staff works in complete harmony with Bombay citizens of all classes and creeds, while as for our workmen they are splendid fellows, and the Indian superior staff and the office staff the same. Finally, your Company out in Bombay is not only looked upon, but treated, with the greatest respect by residents of all classes.

Again on behalf of Mr. Boulter, your Assistant Manager (who is acting for me during my absence), Mr. Gladstone (the Deputy Assistant Manager), and other European and Indian members of the staff I thank you sincerely for your kind remarks. You have also kindly proposed a vote of thanks to your Secretary and staff in London, which I am sure they appreciate fully. From my personal experience I cannot speak too highly of the enormous help they render to the Bombay side—no trouble is too great for them, and the saving they make for us is a very big asset to the Company.

Mr. F. R. SMITH said that he was sure that the remarks Mr. Lane had made regarding their Board would receive the shareholders' full endorsement, and he had great pleasure in proposing a hearty vote of thanks to the Chairman and Directors for their conduct of the affairs of the Company.

This proposition was seconded by Mr. W. S. MAXWELL and unanimously approved, the CHAIRMAN briefly acknowledging.

This terminated the business of the meeting.

Register of Patents

Gas Lamps.—No. 387,535.

NICO LIGHT COMPANY, LTD., and GREEN, R. E., both of Farringdon Avenue, E.C. 4.

No. 8891; March 24, 1932.

Objects of this invention are to provide improved means for attaching a lantern to a gas lamp body and to improve the construction of the lantern, particularly by avoiding the use of a glass bowl.

The lantern encloses the burner and comprises an upper prism-shaped part and a lower tapering part, each part formed by a rigid framework carrying a number of panels (preferably flat) of transparent or translucent material mounted in a readily detachable manner and having a reflector which supports the lantern and which is attached or adapted to be attached to a gas lamp body. The arrangement is such that rain cannot enter the lantern. Each framework may comprise metal angle strips having secured thereto flexible metal tags or similar projections adapted normally to hold the panels in position but capable of being bent to permit removal of the panels, thereby facilitating initial production, subsequent replacement of broken panels, or substitution of panels of different colours or bearing names or advertisement matter.

Grill Burners.—No. 387,871.

KEMPTON, C. H., of Westminster Bridge Road, S.E. 1, and BISSELL, W., of Warwick.

No. 10,080; April 8, 1932.

It is the object of the present invention to provide an extremely simple construction of domestic burner which is specially arranged with means whereby a satisfactory gas distribution along the length of the burner tube may be readily attained.

In a burner having a pair of longitudinal chambers, the gas and air being injected into the one, and being arranged to escape through one or more apertures into the second, whence it passes to the flame apertures, according to the invention the two longitudinal chambers are separated by a plate disposed in the interior of the burner, substantially diametrically thereof, that end of the plate corresponding to the inlet of the burner being provided with a collar which serves to support the tube in a rotatable manner upon the injection nozzle. Preferably, a pivot pin is provided upon that end of the burner tube opposite to the injection nozzle, while the plate serving as the partition may conveniently be located by a step or recess formed in the burner tube at the closed end thereof. The partition may be cut away at its edges, or may be otherwise spaced from the adjacent portions of the burner tube in order to allow the gas to pass to the flame apertures.

Packings of Piston-Type Gasholders. No. 388,327.

BAMAG MEGUIN AKTIENGESELLSCHAFT, of Berlin.

No. 24,406; Convention date, Aug. 12, 1932.

As a rule, state the patentees, the elastic packing pad of the packings of piston-type gasholders is clamped at both edges between rings attached to the wall of the piston. To protect the pad at these clamping points, and to prevent any indentation effect and injurious premature fatiguing of the material, springy auxiliary rings have been disposed between the rings and the edges of the pads.

The invention relates to a further protection of the packing pad against excessive stressing. The customary bearing rings in the interior of the packing are united to form a single channel member which projects into the pad and against which the pad bears after displacement has occurred. Further displacement and consequent stressing of the packing is rendered impossible by the insets. It is also possible to press channels out of the piston wall itself, which channels serve as interior supports for the packing and partially fill the interior space of the leather pad. The patentees claim that, in addition to the latter protection of the pad, greater rigidity of the wall of the piston is attained.

Parliamentary Intelligence.

[From Our Special Correspondents.]

House of Commons.

Private Bills.

The South Suburban Gas Bill has been read a second time and committed.

The Commercial Gas Bill has been considered by the Committee on Unopposed Bills, reported with amendments, and ordered to lie upon the Table for consideration.

The Gas Light and Coke Company Bill was ordered to lie upon the Table for consideration. A Blocking Motion against the bill has been put down by Mr. Thomas Williams, M.P.

Commercial Gas Company's Bill.

Another Bill before Parliament this session for the purpose of preventing housing authorities imposing restrictions upon the tenants of Council dwellings as to the form of light, heating, power, and energy they may use is that of the Commercial Gas Company, but unlike that promoted by the Gas Light and Coke Company for a similar purpose, it was not opposed in Committee. Its consideration, on Wednesday, May 3, by the Unopposed Bills Committee of the House of Commons (over which Capt. R. C. Bourne, Deputy Chairman of Ways and Means, presides) occupied only a few minutes.

Mr. A. B. WINSER (of Messrs. Sherwood & Co., Parliamentary Agents) said that the Company had been supplying gas for 85 years, and that it supplied some of the poorest areas, including slum areas in the East of London. It was desired to check the activities of the Stepney Borough Council in fostering its own electricity undertaking at the expense of the Company's gas undertaking. The Company had the satisfaction of having effected a settlement with the Council, however, and the Council was not opposing the Bill.

After a comment by the Chairman that the question involved was really one of principle, which was really one for the House, the preamble of the Bill was proved, and the Bill was ordered to be reported for third reading.

(Since the Bill was deposited further provisions have been added (by agreement) to the main clause. For instance, there is a proviso (somewhat similar to that included in the Gas Light and Coke Company's Bill) that the provisions of the clause should not apply to any reasonable term or condition as to the positions of fittings in the buildings. By another addition it is provided that the clause shall not apply to certain premises, specifically named, occupied by any tenant of the Stepney Borough Council under an agreement subsisting on Dec. 31, 1932, so long as such tenancy continues. It is also provided that the clause shall apply to dwelling-houses owned by the Company and occupied by workers, whether employed by the Company or not, as if the Company were a housing authority within the meaning of the Act.)

GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

Despite the uncertainty which exists in regard to President Roosevelt's financial policy and the depreciation of the dollar, the Stock Exchange was not to any great extent adversely affected last week. The volume of business was less mainly by reason of the short week and the end of the Account, but the general tone was firm. Consequent on a rise in commodity prices there were several interesting features, notably copper and tin shares, which were well supported, while inquiries for rubber issues brought about some appreciation in values. Home rails also hardened. The only important relapse was in British Funds, which closed a trifle easier on the week.

The popularity of Gas stocks and shares, as is evidenced by the volume of business each week, shows no sign of abating and prices continue to improve. Montevideo ordinary hardened 10 points to 45-50, and transactions were recorded at the top price. East Hull ordinary and Northampton 5% maximum both gained 5 points to 108½ and 105½ respectively; Uxbridge 5% preference rose 2 points to 112½; and others showed fractional gains. Gas Light 4% preference eased 1 point to 102½.

The accounts of the Colombo Gas and Water Company, Ltd., show that the balance of the net revenue account for the year to Dec. 31 last amounted to £18,835 (against £19,763), out of which the Directors recommend the payment of final dividends of 3½% on the 7% preference shares and 5% on the ordinary shares, both less income-tax, making 7% and 10% respectively for the year (the same). After allocating £1000 to general reserve, the balance forward is £12,031, against £12,958. The report states that the sales of gas were slightly higher than those for the previous year. The Company's ordinary shares are now quoted at 25s.-30s., and the yield on the dividend paid works out at £7 5s. 6d. p.ct.

Current Sales of Gas Products.

The London Market for Tar Products.

LONDON, *May* 8.

The position in the tar products market is as follows:

Pitch remains quiet, and the price is called 85s. to 90s. per ton f.o.b.

Creosote is about 2½d. to 3d. per gallon f.o.b.

Refined tar is about 4d. to 4¼d. per gallon in bulk at makers' works.

Pure benzole is about 1s. 11d.; pure toluole, about 2s. 4d. to 2s. 5d.; solvent naphtha, 95/160, about 1s. 8d.; and 90/140 pyridine bases, 3s. 6d. to 3s. 9d. per gallon naked at makers' works.

Tar Products in the Provinces.

May 8.

The average prices of gas-works products during the week were: Gas-works tar, 32s. 6d. to 37s. 6d. Pitch—East Coast, 82s. 6d. to 85s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 82s. 6d. to 85s. f.o.b.* Toluole, naked, North, 1s. 9d. to 1s. 10d. Coal-tar crude naphtha, in bulk, North, 6d. to 6¼d. Solvent naphtha, naked, North, 1s. 5½d. to 1s. 6d. Heavy naphtha, North, 10d. to 11d. Creosote, *ex* works, in bulk, North, liquid and salty. 2d. to 2¼d.; low gravity, 1¾d. Scotland, 2d. to 2½d. Heavy oils, in bulk, North, 4d. to 4¼d. Carbolic acid, 60's, 2s. 9d. to 2s. 10d. Naphthalene, £9 to £10. Salts, 35s. to 75s., bags included. Anthracene, "A" quality, 2¼d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *May* 6.

Values remain easy in most departments, although throughput is fairly satisfactory. Stocks are gradually being reduced.

Crude gas-works tar.—The actual value is 42s. 6d. to 47s. 6d. per ton *ex* works.

Pitch.—Export value is purely nominal at 77s. 6d. to 80s. per ton f.o.b. Glasgow. The home price is now 80s. per ton *ex* works in bulk.

Refined tar to Ministry of Transport specification is moving in substantial quantities at 3½d. to 3¾d. per gallon *ex* works naked, according to quantity.

Creosote oil.—The home market is consuming quite substantial quantities. B.E.S.A. specification is 2¼d. to 2¾d. per gallon; low gravity, 2d. to 2¼d. per gallon; and neutral oil, 2½d. to 2¾d. per gallon; all in buyers' rail tanks *ex* works.

Cresylic acid.—Prices now appear to be at their lowest. Pale, 97/99%, is 10d. to 11d. per gallon; dark, 97/99%, 9d. to 10d. per gallon; and pale, 99/100%, 1s. 1d. to 1s. 2d. per gallon—all f.o.r. in buyers' packages.

Crude naphtha remains scarce, and 4½d. to 5d. per gallon *ex* works according to quality is obtainable for available supplies.

Solvent naphtha.—90/160 grade is 1s. 3d. to 1s. 4d. per gallon, and 90/190 grade 11d. to 1s. per gallon *ex* works.

Motor benzole. Supplies are short, and quotations are round 1s. 4d. to 1s. 5d. per gallon *ex* works in bulk.

Pyridines.—90/160 grade is 3s. to 3s. 3d. per gallon, and 90/140 grade 3s. 3d. to 3s. 6d. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s. d.		s. d.	
Crude benzole	0 10½	to	0 11	per gallon at works
Motor ,,	1 6½	,,	1 7	,, ,, ,,
Pure ,,	1 10	,,	1 11	,, ,, ,,

Trade Notes.

Russell Edwards & Co., Ltd.

Mr. A. W. J. Bedbrook, of Grand Buildings, Trafalgar Square, London, W.C. 2 (Telephone No. Whitehall 2201), who is a representative for Messrs. Foster Brothers, Ltd., of Wednesbury, Staffs., for their flanged steel pipework, has also taken over the London representations of Messrs. Russell Edwards & Co., Ltd., of Bamber Bridge, Nr. Preston, for their cast-iron pipes and specials.

Another Big Order for Morris-Commercials.

Among orders received by Morris Commercial Cars, Ltd., of Adderley Park, Birmingham, this week for commercial vehicles is one from the Post Office Stores Department for 100 15-cwt. chassis and 35 1-ton chassis. This order will increase the number of Morris-Commercial vehicles used by the G.P.O. to 1410. This huge fleet of vehicles operates in various centres covering the whole of the country.

Contracts Advertised To-Day.

Boiler House Plant (Complete).

County Borough of Halifax Health Committee. [p. 353.]

Coal.

Barnoldswick Gas Department. [p. 353.]
Devizes Corporation Gas Department. [p. 354.]
East Dereham Urban District Council. [p. 354.]

Fittings, Pendants, Brackets, and Lamps.

City of Leeds Gas Department. [p. 354.]

Mantles.

City of Leeds Gas Department. [p. 354.]

Oxide (New and Spent).

Rochdale Gas Department. [p. 354.]

Pipes and Tubing.

City of Leeds Gas Department. [p. 354.]
Rochdale Gas Department. [p. 354.]

Stores.

City of Leeds Gas Department. [p. 354.]

Gas Acts (1920 and 1929) Orders.

SPECIAL ORDERS.

Bristol Gas Company.

To authorize the Company to use scheduled lands for gas purposes, and to make various other provisions.

Southampton Gas Light and Coke Company.

To authorize the raising of additional capital, to fix a basic price for gas, and to make other financial provisions.

STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

Issue. £	Share.	When ex-Dividend.	Dividends. Prev. Hf-Yr. % p.a.	Dividends. Last Hf-Yr. % p.a.	NAME.	Quotations May 6. (Provincial Exchanges May 5.)	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
1,551,868	Stk.	Apl. 3	7⅞	7	Alliance & Dublin Ord. ...	122—132	...	126½—128
374,000	,,	Jan. 9	4	4	Do. 4 p.c. Deb. ...	85—95	...	97
557,655	,,	Mar. 6	7	7	Barnet Ord. 7 p.c.	157—162	...	160
300,000	1	Oct. 17	1/9⅜	1/4⅜	Bombay, Ltd.	24/6—26/6	...	26/-
178,280	Stk.	Feb. 20	9½	9½	Bournemouth sliding scale	195—205	...	...
550,050	,,	,,	7	7	Do. 7 p.c. max. ...	157—162	...	161½
439,160	,,	,,	6	6	Do. 6 p.c. Pref. ...	137—142	...	...
50,000	,,	Dec. 19	3	3	Do. 3 p.c. Deb. ...	75—80	...	...
162,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	101—106	...	...
210,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	122—127	...	...
357,900	,,	Mar. 6	7½	7½	Brighton, &c. 6 p.c. Con. ...	152—157	...	...
540,000	,,	,,	6⅔	6⅔	Do. 5 p.c. Con. ...	141—146	...	...
195,500	,,	,,	6	6	Do. 6 p.c. B Pref.	136—141	+½	138
1,487,500	,,	Mar. 6	5	5	Bristol 5 p.c. max.	111—113*a*	...	...
120,420	,,	Dec. 19	4	4	Do. 1st 4 p.c. Deb. ...	100½—101½*a*	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	100½—101½*a*	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	120—124*a*	...	...
855,000	,,	Apl. 3	7	8	British Ord.	147—152	...	148—151
100,000	,,	Dec. 19	7	7	Do. 7 p.c. Pref.	147—152	...	...
350,000	,,	,,	—	5½	Do. 5½ p.c. Pref. ...	105—110	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	105—115	...	...
160,000	,,	Jan. 9	5	5	Cambridge 5 p.c. Deb. ...	117—122	...	...
100,000	10	Dec. 5	6	6	Cape Town, Ltd.	7⅛—8⅛	...	8⅛
100,000	10	Apl. 24	4½	4½	Do. 4½ p.c. Pref. ...	6—7*	...	...
150,000	Stk.	Dec. 19	4½	4½	Do. 4½ p.c. Deb. ...	88—93	...	...
626,860	,,	Feb. 20	6	6	Cardiff Con. Ord.	119—124	...	121¾—122½
237,860	,,	Jan. 9	2½	5	Do. 5 p.c. Red. Deb.	105—110	...	...
157,150	,,	Feb. 20	5	6½	Chester 5 p.c. Ord.	97—102*b*	...	...
98,936	1	Oct. 17	2/-	2/-	Colombo, Ltd. Ord.	25/—30/-	...	27/6
24,500	1	Oct. 17	1/4⅜	1/4⅜	Do. 7 p.c. Pref. ...	19/—21/-	...	...
609,204	1	Mar. 20	/11'48	/11'48	Colonial Gas Assn. Ltd. Ord.	16/—18/-	...	...
296,053	1	,,	1/3'30	1/3'30	Do. 8 p.c. Pref.	19/—21/-	...	...
1,796,955	Stk.	Feb. 20	5	5½	Commercial Ord.	112—117	...	...
475,000	,,	Dec. 19	3	3	Do. 3 p.c. Deb. ...	75—80	...	...
265,272	,,	Mar. 6	—	5	Do. 5 p.c. Deb. ...	120—125	...	122½—124
807,560	,,	Feb. 20	7	7	Croydon sliding scale ...	145—150	...	148—149
469,590	,,	,,	5	5	Do. max. div.	101—106	...	...
500,000	,,	Jan. 9	5	5	Do. 5 p.c. Deb.	120—125	...	123—125
542,270	,,	Mar. 6	7	10	Derby Con.	150—160*c*	...	...
55,000	,,	Jan. 9	4	4	Do. 4 p.c. Deb.	80—85*c*	...	...
209,000	,,	Mar. 6	5	5	East Hull Ord. 5 p.c. ...	106—111	+5	110½
179,500	,,	Mar. 6	6	6	East Surrey Ord. 5 p.c. ...	120—125	...	...
155,019	,,	Dec. 19	5	5	Do. 5 p.c. Deb. ...	117—122	...	...
1,002,180	,,	Apl. 3	†5	†7	European, Ltd.	132—137	...	131½—135½
19,373,992	,,	Feb. 20	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	25/—26/-*f*	...	25/4½—25/9
2,600,000	,,	,,	8½	8½	Do. 8½ p.c. max.	85—90	+½	87½—89½
4,477,106	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	101—104	−1	101½—102
6,102,497	,,	Dec. 19	8	8	Do. 8 p.c. Con. Deb. ...	79½—82	...	80½—81½
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	115—118	...	117½
3,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	111—114	...	113—114
270,466	,,	Mar. 6	6	6	Harrogate New Cons. ...	113—118	...	...
82,500	,,	Mar. 6	7	7	Hastings & St. L. 5 p.c. Conv.	138—143	...	...
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	110—115	...	114—115
70,000	10	Apl. 24	†10	†10	Hongkong & China, Ltd. ...	14 15*	...	...
213,200	Stk.	Mar. 6	6	6	Hornsey Con. 3½ p.c.	122—127	...	...
5,600,000	,,	Nov. 21	14	10	Imperial Continental Cap.	212—222	...	212—221
223,130	,,	Feb. 6	3½	3½	Do. 3½ p.c. Red. Deb.	89—94	...	...
235,242	,,	Mar. 6	8½	8½	Lea Bridge 5 p.c. Ord. ...	170—175	...	173½—174½
2,145,907	,,	Mar. 6	6	6	Liverpool 5 p.c. Ord. ...	125—126*b*	...	...
245,500	,,	Dec. 19	5	5	Do. 5 p.c. Red. Pref. ...	105—115*b*	...	...
306,088	,,	Jan. 19	4	4	Do. 4 p.c. Deb. ...	101—103*b*	...	...
165,736	,,	Feb. 20	8	10	Maidstone 5 p.c. Cap. ...	180—200	...	...
56,176	,,	Dec. 19	3	3	Do. 3 p.c. Deb. ...	70—75	...	...
75,000	5	Dec. 5	†10	†10	Malta & Mediterranean ...	8½—10½	...	...
392,000	—	Apl. 1	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	98—103	...	...
231,978	Stk.	Mar. 6	5	5	M. S. Utility "C." Cons. ...	103—108	...	...
818,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	93—98	+1	96
112,126	,,	Jan. 9	4	4	Do. 4 p.c. Deb. ...	102—104	...	...
148,955	,,	,,	5	5	Do. 5 p.c. Deb. ...	115—120	...	...
675,000	,,	21 May '31	16	16	Montevideo, Ltd.	45—55	+10	49—50
2,061,315	,,	Mar. 6	5	5½	Newcastle & Gateshead Con.	24/3—25/3*d*	...	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	100—102*d*	...	...
776,706	,,	Jan. 9	3½	3½	Do. 3½ p.c. Deb. ...	90—92*d*	...	...
277,285	,,	Nov. 7	5	5	Do. 5 p.c. Deb. '43...	107—109*d*	...	...
274,000	,,	Feb. 20	5	5	Newport (Mon.) 5 p.c. max.	99—101*a*	...	...
204,940	,,	Mar. 20	7½	7½	North Middlesex 6 p.c. Con.	132—142	...	138
396,160	,,	Feb. 6	5	5	Northampton 5 p.c. max. ..	103—108	+5	...
300,000	,,	Apl. 24	9	7	Oriental, Ltd.	114—119*	...	...
205,162	,,	Dec. 19	8	8	Plym'th & Stonehouse 5 p.c.	155—165	...	...
504,416	,,	Feb. 20	8	8	Portsm'th Con. Stk. 4 p.c. Std.	160—165	...	...
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	102—107	...	...
114,000	,,	Feb. 20	5	5	Preston 5 p.c. Pref.	103—108	...	...
686,312	,,	Jan. 23	4	4	Primitiva 4 p.c. Rd. Db. 1911	82—87	...	...
389,813	,,	Dec. 19	4	4	Do. 4 p.c. Cons. Deb.	82—87	...	...
150,000	10	Mar. 20	6	6	San Paulo 6 p.c. Pref. ...	6⅞—7⅛	...	...
1,736,968	Stk.	Sept. 5	6	6	Sheffield Cons.	122—124*e*	...	...
95,000	,,	Jan. 9	4	4	Do. 4 p.c. Deb.	91—95*e*	...	...
133,201	,,	Feb. 20	3½	5	Shrewsbury 5 p.c. Ord. ...	125—130	...	...
90,000	10	June 6	15	15	South African	3—5	...	...
6,709,895	Stk.	Feb. 20	5	7	South Met. Ord.	127—130	...	127—128½
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	138—143	...	139½—140½
850,000	,,	,,	—	20/-*g*	Do. 4 p.c. Irred. Pf.	100—104	...	100—102
1,895,445	,,	Jan. 9	3	3	Do. 8 p.c. Deb. ...	80—83	...	81½
1 000,000	,,	Jan. 23	5	5	Do. 5 p.c. Red. Deb.	114—117	...	...
209,820	,,	Mar. 6	3½	3½	South Shields Con.	147½—152½*d*	...	...
1,543,795	,,	Feb. 20	6	6	South Suburban Ord. 5 p.c.	124—129	...	128½—129
300,000	,,	,,	5	5	Do. 5 p.c. Pref.	113—118	...	115½—116½
868,837	,,	Dec. 19	5	5	Do. 5 p.c. Deb.	120—125	...	...
647,740	,,	Feb. 20	5	5	Southampt'n Ord. 5 p.c. max.	107—112	...	...
121,275	,,	Dec. 19	4	4	Do. 4 p.c. Deb.	100—105	...	...
350,000	,,	Mar. 6	9/-	5½	Swansea 5½ p.c. Red. Pref.	108 112	...	...
200,000	,,	Dec. 19	6½	6½	Do. 6½ p.c. Red. Deb.	105—110	...	...
1,076,490	,,	Mar. 6	6⅔	6⅔	Tottenham and District Ord.	142—147	...	144
300,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	123—128	...	...
62,285	,,	,,	5	5	Do. 5 p.c. Pref. ...	110—115	...	...
199,005	,,	Dec. 19	4	4	Do. 4 p.c. Deb. ...	98—103	...	...
85,701	,,	Apl. 3	6	6	Tuscan, Ltd., 6 p.c. Red. Db.	80—85	...	...
347,769	,,	Mar 6	7	7	Uxbridge, &c., 5 p.c. ...	140—145	...	143—143½
88,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	110—115	+2	114—114½
1,322,220	,,	Mar 6	7	7	Wandsworth Consolidated	145—150	...	148½—149
1,096,373	,,	,,	5	5	Do. 5 p.c. Pref.	112—117	...	117
1,317,964	,,	Dec. 19	5	5	Do. 5 p.c. Deb.	120—125	...	123½—124
158,400	,,	Mar. 6	5	6⅄	Winchester W.&G. 5p.c. Con.	105—110	...	...

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The authors commenced this book with a belief and an aim. The belief is that a knowledge of the *principles* of gas utilization is a *sine qua non* of effective salesmanship in the Gas Industry; the aim was to deal simply and logically with these principles. Quite definitely the result bears no relation to a catalogue of gas-using appliances, but it is hoped that, with this book as a first step, the reader will in some measure be fitted to interpret the mechanism of gaseous combustion, to differentiate between good and bad apparatus and good and bad installation, and to appreciate underlying reasons for modification in design. It is hoped, too, that the book will be of immediate service to the younger members of the Gas Industry who, keen on their work, are embarking on the various examinations which assist in establishing a useful career in the Industry. It should be of special utility to those in the Second and Third Years (S2 and S3) of the Institution of Gas Engineers' Major Course in Gas Supply, and for those in the Third Year of the Minor Course in Gas Supply Practice.—*Extract from the Authors' preface.*

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NOON ON TUESDAY is the latest hour for receipt of advertisement copy for the following day's issue.

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(*See advertisement last week*, p. 248.)

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CONTRACTS OPEN.

BARNOLDSWICK URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE above Council invite Tenders for the Supply and Delivery of 6000 Tons of GAS COAL during the year ending 30th June, 1934. Washed Single and Double Screened Nuts required.

Sealed Tenders, endorsed "Gas Coal," must be forwarded so as to reach the undersigned not later than the first post on Saturday, the 20th May, 1933.

Forms of Tender are not issued.

The Council do not bind themselves to accept the lowest or any Tender.

ROBERT W. FENTON,
Clerk of the Council.

Town Hall,
Barnoldswick,
via Colne.

OXIDE OF IRON.

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(HEALTH COMMITTEE.)

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The Laundry Equipment, Heating, and Hot Water systems are provided in separate contracts. The demands on the Boiler House Scheme are given in the Specification.

Tenders are to be accompanied by full Specification of all units to be supplied, and plans of layout of Boiler House.

Plans may be seen and all particulars obtained on application to Mr. D. T. LLOYD JONES, BOROUGH ENGINEER, CROSSLEY STREET, HALIFAX, from whom Specification and Form of Tender may be obtained on payment of a deposit of £2 2s. (Cheques to be made payable to the "Halifax Corporation"), which will be returned on receipt of a *bona-fide* Tender.

Sealed Tenders, endorsed "Isolation Hospital, Boiler House Plant," must be delivered to the undersigned not later than Twelve noon, Wednesday, May 31st, 1933, and persons tendering must state whether or not they are on the King's Roll.

The Contractor whose Tender is accepted will be required to observe the Fair Contracts Clauses adopted by the Corporation.

The Committee do not bind themselves to accept the lowest or any Tender.

PERCY SAUNDERS,
Town Clerk.

Town Hall,
Halifax,
May 3, 1933.

(*Continued on p.* 354.)

ROBERT DEMPSTER & SONS, Ltd., ELLAND, Builders of CARBONIZING PLANTS, both Horizontal and Vertical. Manufacturers of CONDENSERS, PURIFIERS, GAS-HOLDERS, &c., also every description of COAL and COKE HANDLING PLANT. Telegrams: "DEMPSTER, ELLAND." Telephone: ELLAND 261 (Private Branch Exchange).

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COUNTY BOROUGH OF ROCHDALE.

(GAS DEPARTMENT.)

TENDERS are invited for the Supply of NEW OXIDE OF IRON and the Purchase of SPENT OXIDE, f.o.r. Rochdale, during a period of Twelve Months ending 30th June, 1934.

Separate or combined Tenders for each class may be submitted.

Tenders, endorsed "Oxide," addressed to the Engineer and Manager, Gas-Works, Rochdale, must be delivered not later than noon on Saturday, the 27th May, 1933.

By order,
WM. HENRY HICKSON,
Town Clerk.

Town Hall,
Rochdale,
May 4, 1933.

COUNTY BOROUGH OF ROCHDALE.

(GAS DEPARTMENT.)

TENDERS are invited for the Supply of CAST-IRON MAIN PIPES and SPECIALS as may be required during a period of Twelve Months ending 30th June, 1934.

Forms of Tender and any further information may be obtained on application to the Engineer and Manager, Gas-Works, Rochdale.

Tenders, endorsed "Cast-Iron Pipes," and addressed to the Engineer and Manager, Gas-Works, Rochdale, must be delivered not later than noon on Saturday, the 27th May, 1933.

By order,
WM. HENRY HICKSON,
Town Clerk.

Town Hall,
Rochdale,
May 4, 1933.

EAST DEREHAM URBAN DISTRICT COUNCIL.

TENDERS are invited for the Supply of about 2000 Tons of SCREENED GAS COAL or NUTS for the year ending 30th June, 1934.

Forms of Tender can be obtained from the undersigned.

Tenders, marked "Coals," to be forwarded to me so as to reach my office not later than 10 a.m. on Tuesday, 6th June, 1933.

C. H. REEDER,
Clerk to the Council

East Dereham,
May 8, 1933.

CITY OF LEEDS.

(GAS DEPARTMENT.)

THE Gas Committee are prepared to receive TENDERS for the Supply of the following STORES for Twelve Months from date of order:

CAST-IRON PIPES.
WROUGHT IRON TUBES and FITTINGS.
IRON CASTINGS.
Best MERCHANT IRON and MILD STEEL.
BOLTS and NUTS, IRON and BRASS MACHINE SCREWS and NUTS.
GAS and PIPE HOOKS.
TINPLATES, BLACK and GALVANIZED IRON.
LEAD COATED IRON.
WOOD SCREWS and TOOL BASSES.
SOLDERING FLUID and DIRT REMOVER.
EMERY PAPER and TWINE.
HACKSAW BLADES and FOOTPRINT WRENCHES.
GRILL PANS, GRIDS, and DRIP TINS.
SHOVELS, COKE FORKS, and FILES.
GALVANIZED BUCKETS.
BRUSHES of Various Kinds.
SHEET LEAD, LEAD TUBE, and WHITE LEAD.
OILS, GREASES, and TURPENTINE.
TURPENTINE SUBSTITUTE and METHYLATED SPIRIT.
LEAD WOOL.
Best ENGINE TALLOW and WAX CANDLES.
SPONGE CLOTHS, SCOURERS, and METAL POLISH.
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BRASS GAS FITTINGS.
GAS MANTLES and LAMP PANES.
STREET LANTERNS.
FLEXIBLE METALLIC TUBES.

All articles to be delivered at the Stores, Regent Street (or at the Gas-Works or Depôts specified on the order), at the price tendered. Samples of the various articles may be seen at our Stores Office, Bridge Street.

Forms of Tender may be obtained from the undersigned.

Tenders, endorsed "Gas Department, Tenders for Stores," must be addressed to the Town Clerk, 26, Great George Street, Leeds 1, to be delivered not later than May 20, 1933.

The Committee do not bind themselves to accept the lowest or any Tender.

C. S. SHAPLEY,
M.I.Mech.E., M.Inst.Gas E.,
Engineer and General Manager.

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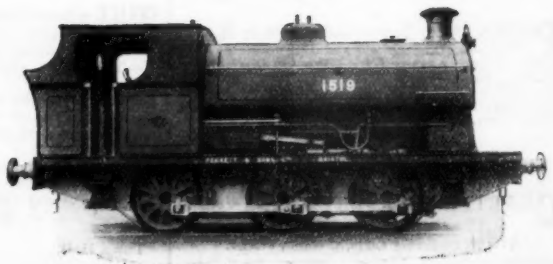

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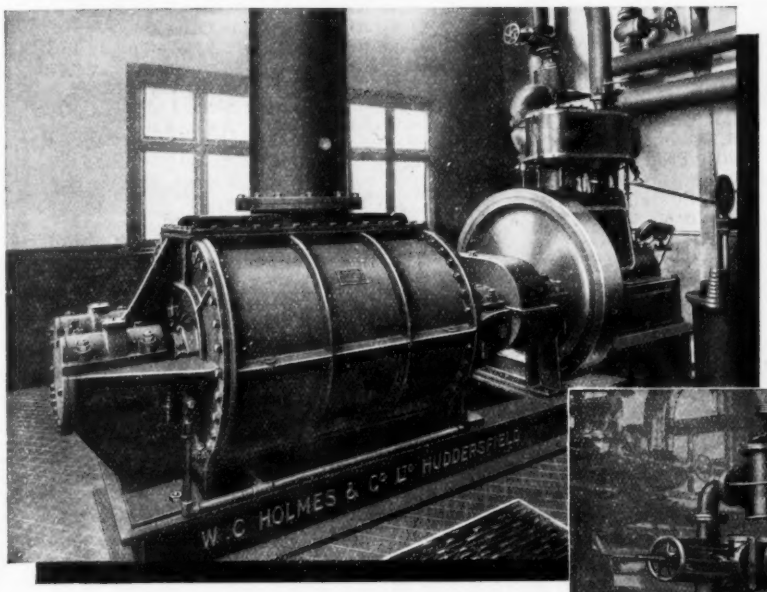

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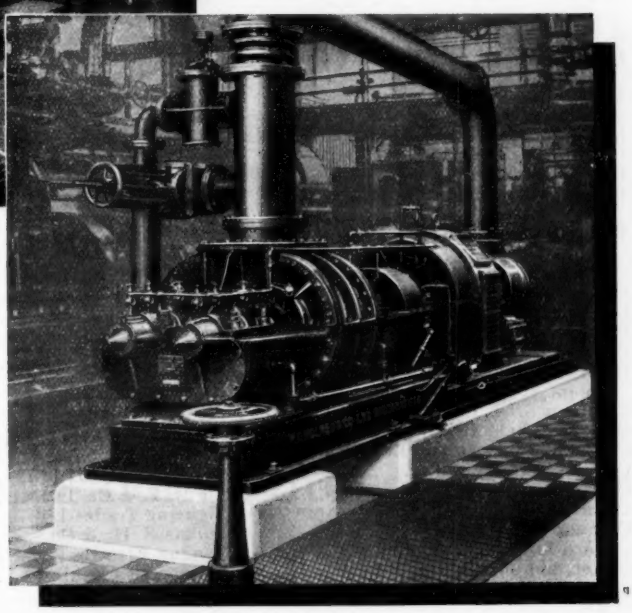

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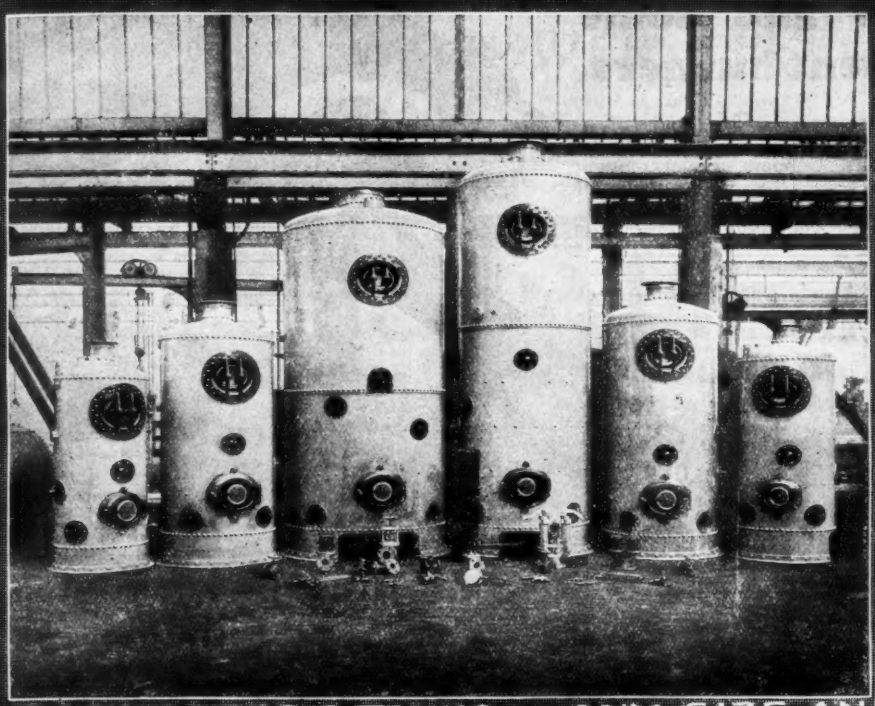

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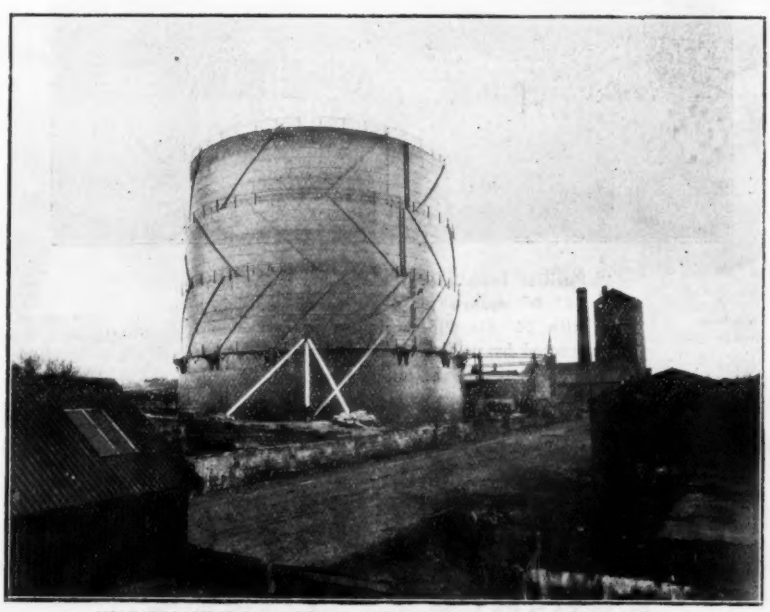

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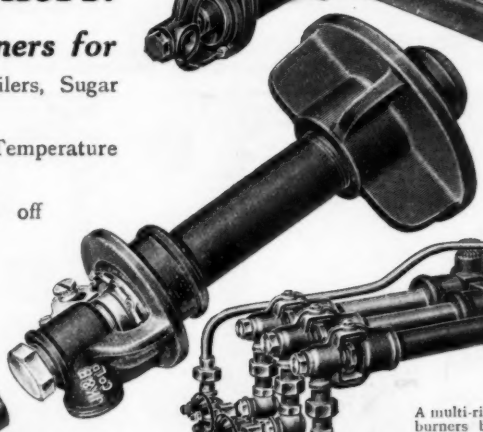

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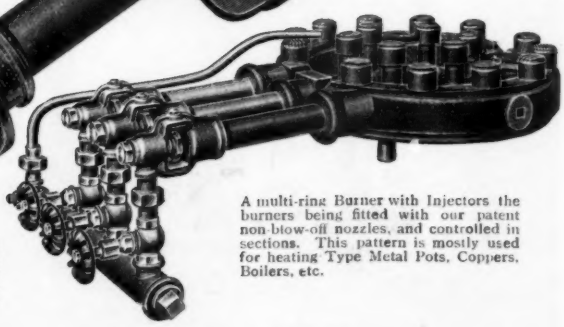

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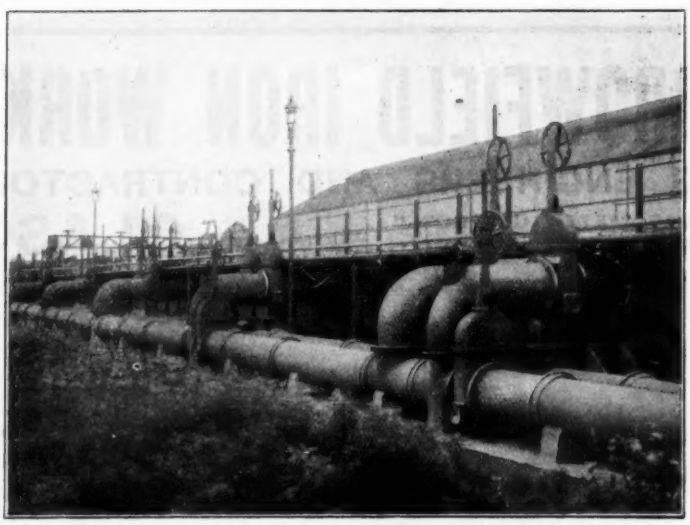

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